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LOUGHNANE (J. B.). **A Survey of the Aphis Population of Potato Crops in Ireland in Relation to the Production of Seed Potatoes.**—*J. Dep. Agric. Éire* **37** no. 2 pp. 370–382, 1 map, 1 graph, 14 refs. Dublin, 1940.

In view of the part played by Aphids, especially *Myzus persicae*, Sulz., in the dissemination of virus diseases of potato, a survey was made in 1938–39 of the Aphid populations of potato crops in seed-potato districts in seven counties in Eire. The method used consisted in counting the Aphids on 5–6 leaves of each plant along the diagonals of the field. Most of the counts were made in early June, to ascertain the approximate date of initial infestation, in mid-July, to ascertain the maximum numbers of Aphids likely to be present, and in mid-August, to cover the possibility of a late outbreak. The areas concerned are briefly described, and a table is given showing the numbers of crops and leaves examined and the numbers of winged and wingless examples of each of the four commoner Aphids found in each inspection. In addition to *Myzus persicae*, there were present *Macrosiphum solanifolii*, Ashm. (*gei*, auct.) and *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.), both of which occurred in insignificant numbers in all the centres visited, and *Aphis rhamni*, Boy., which had a somewhat uneven distribution but became very abundant in August 1939 in the Athlone area.

*Myzus persicae* was present at all the centres, but mostly in very small numbers. It was fairly abundant in August 1939 in three counties, but this was of slight importance, as the plants are then less susceptible to infection and most of the Aphids are wingless, so that disease is not spread to any considerable extent. The highest numbers of *M. persicae* (109·3 per 100 leaves in May and 92 in June) were obtained in 1938 at a place where the potato plots are in a sheltered position at a low elevation and close to a market garden in which winter and spring cabbages are grown. It has been shown [*cf. R.A.E.*, A **22** 386; **24** 61] that *M. persicae* is able to reproduce slowly throughout the winter on such plants. Factors influencing its prevalence, such as the presence of suitable food-plants and the effect of temperature, humidity and wind velocity on flight, are discussed from the literature [*cf. 23* 492; **24** 551; **26** 379; **27** 633, etc.], and it is concluded that conditions in the seed-growing areas of Eire do not favour its increase and spread. Sexual forms do not appear to be produced there, and such winter food-plants as swedes, rape and cabbage are scarce in most areas, which results in a low Aphid population on potatoes in spring. Other factors that prevent large populations, especially in coastal districts, are high wind velocities and high relative humidity, which, particularly in the west, is considerably above 70 per cent. [*cf. 26* 709]. It is considered that the present isolation of the seed-potato districts from urban areas where winter cabbages are likely to be grown renders them safe from infestation by winged migrants in spring. The growing of healthy stocks should, however, be confined to districts in which the population of *M. persicae* is low.

Other Aphids observed on potatoes were *Aphis rumicis*, L., which was rare, and *Drepanosiphum platanoides*, Schr., winged females of which frequently occurred on potatoes growing near sycamore trees [*Acer pseudoplatanus*].

**Thirty-fourth Annual Report of the Department of Agriculture (British Columbia) for the Year 1939.**—146 pp., ill. Victoria, B.C., 1940.

In the report of the Horticultural Branch (pp. B34-B56), W. H. Robertson states that *Tetranychus pacificus*, McG., was recorded in 1939 for the first time in British Columbia. The first infestation found was confined to a single nursery, and the movement of trees from it was prohibited until all stock had been dipped in winter-strength lime-sulphur, but after this a second was discovered that possibly extended over an area of 150 acres and was quite severe over at least 50 acres. The mite is apparently largely spread by wind and has moved rapidly north from the Wenatchee district of Washington, where it was first observed in 1930. The development of the codling moth [*Cydia pomonella*, L.] on apple was abnormal. As a result of early hot weather, plant growth was rapid, the moths began emerging in early May and spraying was begun ten days earlier than usual. This was followed by cool weather lasting until the end of June, so that emergence was prolonged, few eggs were laid and hatching was delayed. In consequence, first-generation larvae appeared very late; there were very few at thinning time and the greatest entry into the apples occurred between 23rd June and 10th July. Where three cover sprays were properly applied, there was little more damage than usual, but when only two were given, there was a considerable increase. Cryolite was substituted for lead arsenate in the sprays against the second generation in order to reduce the arsenic residue at harvest. There was some increase in infestation by this generation, but it is considered that this was due to poor control of the first generation and not to the use of cryolite. Various soaps proved equally effective as spreaders for use with cryolite, and a concentration of  $\frac{1}{2}$  pint liquid soap per 100 gals. spray or 1 oz. flake soap per 30 gals. was recommended. The mealybug [*Pseudococcus* sp.] that attacks fruit trees in the Kootenays is spreading to new areas every year. Tests of sprays against it confirmed the results of the previous year [cf. *R.A.E.*, A 29 23]; Elgetol [a preparation containing a salt of dinitro-cresol] was the most effective of those tested in 1939, but was expensive.

In the report of the Provincial Entomologist (pp. B62-B63), M. H. Ruhmann gives records of the prevalence of the principal pests observed during the year. Excellent control of *Leptinotarsa decemlineata*, Say, was obtained by growers where infested potatoes were dusted with calcium arsenate. Incipient outbreaks developed in three districts, presumably from seed potatoes introduced from infested Prairie districts. *Paratrioza cockerelli*, Šulc, which has been reported as crossing the boundary from Alberta [cf. 27 176], was not recorded in British Columbia during the year. A list is given of the districts known to be infested with *Aspidiotus perniciosus*, Comst., which is gradually spreading in orchards in the interior. A severe local infestation by *Hylemyia cilicrura*, Rond., was observed in a commercial planting of beans, this being apparently the first record of this Anthomyiid in the interior of British Columbia.

SWEZEY (O. H.). **A Survey of the Insect Pests of cultivated Plants in Guam.**—*Hawaii. Plant. Rec.* 44 no. 3 pp. 151-182, 15 figs. Honolulu, 1940.

This full report [cf. *R.A.E.*, A 25 294] on a survey in Guam, undertaken in 1936, to determine what noxious insects might be carried by

aircraft to Hawaii, contains notes on large numbers of pests on some 20 crops. Those attacking coconut include *Aspidiotus destructor*, Sign., which was injurious in 1924 and 1925, but was controlled by natural enemies such as Chalcidoid parasites and the Coccinellid, *Telsimia nitida*, Chapin. It was found in small colonies on the leaves of coconut, avocado, mango, banana, grape-vine and *Citrus* and was always accompanied by *T. nitida*. This Coccinellid, which was described from Guam in 1926 [15 181], has been erroneously recorded as *Cryptogonus orbiculus* var. *nigripennis*, Weise, in Guam [14 641; 15 417; 17 48, 604; 19 197] and in Hawaii, where it was introduced against *Pinnaaspis buxi*, Bch., and readily became established [cf. 27 367; 28 461]. A Hispid beetle, reported as killing coconut palms on the neighbouring island of Saipan, was described by Spaeth (1937) as *Brontispa mariana*. It attacks the crown of the tree and appears to have been introduced fairly recently. Attempts are being made to prevent it from reaching Guam.

The most important pests of maize were *Pyrausta nubilalis*, Hb., *Heliothis armigera*, Hb., *Phytomyza spicata*, Mall., and *Aphis maidis*, Fitch. *Pyrausta nubilalis*, which was first observed in Guam in 1911 and was reported to be destroying half the crop by 1925, did not attack any other plant. A Tachinid identified as *Ceromasia lepida* or *Lydella stabulans* var. *grisescens*, R.-D. [the species commonly known as *C. senilis*, Mg.] was introduced from Japan in 1931 [cf. 22 687] and was controlling *P. nubilalis* satisfactorily in 1936, when the degree of parasitism was usually about 50 per cent. and sometimes much higher. The larvae of *Phytomyza spicata* feed freely in the leaves of young plants, but less in the new leaves of older ones, possibly because they are parasitised by a Eulophid that occurs in large numbers. They produce as many as 100 narrow longitudinal mines per leaf, chiefly in the apical half, and probably check the early growth of the plants. Severe infestation by *A. maidis* often occurs in the tassels when they are about to expand, but the Aphid is rapidly controlled by Coccinellids, of which the most important are *Coccinella (Harmonia) arcuata*, F., and *Coelophora inaequalis*, F. Several hundred of the former were sent to Honolulu, but apparently failed to become established. The larvae of *Xanthogramma (Ischiodon) scutellare*, F., feed on the Aphid; 38 undetermined Chalcidoid parasites emerged from a puparium of this Syrphid collected on a leaf of maize.

Sugar-cane is attacked by a number of insects, including the Aleurodid, *Neomaskellia bergi*, Sign., the Derbid, *Proutista moesta*, Westw., and the Delphacid, *Perkinsiella thompsoni*, Muir, which do not occur in Hawaii. *P. thompsoni* was too rare to be injurious, and its eggs were heavily parasitised by a Mymarid, apparently *Paranagrus optabilis*, Perkins. Pests of rice included *Susumia exigua*, Btlr., and *Spodoptera mauritia*, Boisd. *Susumia* appears to have been present in Guam for some years. It is usually most abundant in seedling plots and injures the young plants considerably; it is sometimes heavily parasitised by the Braconid, *Apanteles guamensis*, Hlmgr., which attacked 66 per cent. of the larvae in one mature field, but was not present in a heavily infested seed bed. *Spodoptera* occurs in grassland, but causes severe damage to seedling rice in some years. The Ichneumonid, *Echthromorpha conopleura*, Krieger, was bred from the pupae, and on one occasion the percentage parasitism was 22.

Larvae of *Prodenia litura*, F., cause conspicuous damage to the leaves of banana. The eggs are laid in clusters of about 300-400 on the lower

surface of the leaf, and though only a small proportion of the larvae reach maturity, their feeding shortens the functional life of the leaves. In October 1936, a colony of the Scelionid, *Telenomus nawai*, Ashm., was introduced from Honolulu, where it effectively parasitises the eggs of *Laphygma exempta*, Wlk., and was reared on eggs of *Prodenia*. It was liberated in various districts, and parasitised eggs were subsequently collected at several places, indicating that it had become established; it also attacked the eggs of *Spodoptera mauritia*. Mango pests included the adults of a Eumolpid identified as *Phytorus lineolatus*, Weise, which almost completely defoliated the trees and also fed on coconut, breadfruit, grape-vine, sour-sop [*Annona muricata*], avocado, orange and several forest trees. It has been misidentified in Guam as *P. pinguis*, Baly [cf. 19 197]. Guava is attacked so severely by the Tortricid, *Spilonota holotephras*, Meyr., the larvae of which feed in the new leaves and cripple the growth, that scarcely any fruits are produced, although they were abundant a few years ago.

A list of the pests that occur in Guam but not in Hawaii is appended.

POLLACCI (G.) & GALLOTTI (M.). **Il *Solanum nigrum* come insetticida per uso agricolo.** [Black Nightshade as an agricultural Insecticide.]—*Boll. Soc. ital. Biol. sper.* **15** no. 2 pp. 328–330. Naples, 1940.

Experiments by the authors have shown that an infusion or extract of the unripe fruits of *Solanum nigrum* is toxic to insects and that the toxic principle is solanine, an alkaloid that is present in a number of solanaceous plants. It is preferable to extract the solanine, as a reliable spray with a definite concentration can then be obtained. A method of making and purifying the extract is described. It is cheap, and a 0.05 per cent. aqueous solution is used for spraying. The spray is odourless and does not injure plants or soil the foliage.

HOGAN (T. W.). **The Argentine Ant in Victoria. A Report on Survey and Control Measures adopted following its Discovery in Melbourne.**—*J. Dep. Agric. Vict.* **38** pt. 10 pp. 486–493, 2 figs., 7 plans. Melbourne, 1940.

A survey of the metropolitan area of Melbourne, where *Iridomyrmex humilis*, Mayr, was first found in September 1939 [cf. *R.A.E.*, A **28** 443] disclosed two major infestations and 13 small ones. The boundaries of the infested areas, which are shown on a series of plans, were defined and the removal of plants from them was prohibited. It was found that the survey could be carried out successfully only on fairly calm days with temperatures of between 60 and 90°F., and that the ants were most active when the humidity was high. They caused much annoyance in houses, some of which were vacated in consequence, and damaged all kinds of food, particularly sweets or cooked meat. They frequently occurred even in ice chests and refrigerators.

In November 1939, experiments were begun on four properties in two streets with a bait similar to one already noticed [cf. **23** 171]. The tins containing it were placed round the infested houses about 10 ft. apart and round the borders of the property and some were hung on the sides of trees on which trails of ants could be seen, particularly those infested with Coccids or Aphids. The bait was renewed at the

end of January and again early in May. This measure proved to be very effective, as the ants ceased to enter the houses and there was a marked decrease in their abundance.

Attention is drawn to the fact that the natural spread of *I. humilis* is very slow, but that its accidental transport by human agency is an important factor. Potted plants are one of the most likely means of transport.

MILLER (D.). **The Australian Grape-vine Moth** (*Phalaenoides glycine*).—*Cawthron Inst. Publ.* no. 41, 4 pp., 4 figs., 1 ref. Nelson, N.Z., 1940.

Grape vines in Auckland, New Zealand, have been attacked by the Agaristid, *Phalaenoides glycinæ*, Lewin, which is one of the major pests of vines in Australia. Descriptions are given of the larva and adult. The larvae can be controlled by a spray of lead arsenate [*cf. R.A.E.*, A 26 111], applied as soon as they appear in spring. More than one application may be necessary if the infestation is severe.

**Cawthron Institute, Nelson, New Zealand. Annual Report 1939.**—34 pp. Nelson, N.Z. [1940.]

Parts of this report (pp. 17–18, 24–29) deal with work on insects in New Zealand during 1939. With the view to studying the seasonal cycle of the woolly apple aphid [*Eriosoma lanigerum*, Hsm.], experimental colonies were established in Nelson in December 1938, and seven generations were obtained up to June 1939 [*cf. R.A.E.*, A 27 548], after which all the Aphids were killed by cold. There had been a prolonged drought from early January to mid-April, followed by heavy rains in late autumn, and spells of severe cold with snow occurred in winter. The few Aphids that survived the winter in the orchards matured in October and commenced to build strong colonies. The parasite, *Aphelinus [mali]*, Hald., which had appeared early in September 1938 and then steadily increased in numbers, also suffered high mortality during the winter of 1939.

*Coptotermes acinaciformis*, Frogg., which causes severe damage to constructional timbers [*cf. 28 399*], has been found infesting native trees as well as oak and poplar. Of other insects infesting timber, the Cerambycid, *Ambeodontus tristis*, F., is also of major importance. Severe damage to extensive areas of pasture has been caused by the grass caterpillars [*Porina*] [*cf. 29 89*] and the grass grub [*Odontia zealandica*, White]. The latter presents a dual problem as the adults are injurious to crucifers and other plants [*23 181*] and an attempt is being made to secure parasites from overseas that will attack the larvae.

Observations on the two Ichneumonids introduced against the diamond back moth [*Plutella maculipennis*, Curt.] showed that *Thyraeella (Diadromus) collaris*, Grav., has become well established in Hawke's Bay [*cf. 28 28*], having apparently spread naturally over a considerable area, while *Angitia cerophaga*, Grav., is thriving in the South Island, but is not doing so well in the North Island. *Plutella* was responsible for practically all the caterpillar damage to crucifers reported, as the white butterfly [*Pieris rapae*, L.] was well controlled by *Pteromalus puparum*, L. [*cf. 28 27*]. Of the larval parasites introduced against *Pieris rapae*, *Apanteles rubecula*, Marsh., seems likely to be of more value than *A. glomeratus*, L. [*cf. 28 28*; *29 314*].

The gorse-seed weevil [*Apion ulicis*, Forst.] introduced against gorse [*Ulex europaeus*] [cf. 28 99] has spread in the environs of the breeding areas at the Cawthron Institute and has been found at a distance of 9 miles. A total of 44,500 examples of this weevil were despatched to different parts of the Dominion, and a large consignment was sent to Tasmania. The ragwort-seed fly [*Hylemyia jacobaeae*, Hardy] was found to have become established on ragwort [*Senecio jacobaea*] in two areas in which it had been released. About 250,000 puparia of this Anthomyiid were received in good condition in four consignments from England; they were kept in cool storage until January or February 1940 and then at normal air temperature. Flies emerged in large numbers during late summer and autumn, and eggs laid by them on ragwort in an experimental area were subsequently found to have hatched. Further liberations of the sawfly [*Antholcus varinervis*, Spin.] imported from Chile against piripiri [*Acaena*] have been made, but it is slow in establishing itself and has not yet proved of value.

DICK (R. D.). **Observations on Insect-life in Relation to Tussock-grassland Deterioration. Preliminary Report.**—*N. Z. J. Sci. Tech.* (A) 22 no. 1A pp. 19A–29A, 6 figs., 4 refs. Wellington, N.Z., 1940.

To determine whether insects are responsible for the deterioration of the New Zealand tussock-grassland (pastures in which the important grasses include *Poa caespitosa* and *Festuca novae-zealandiae*), a survey was carried out in February and March 1939 in the central part of the South Island. The present state of the grassland is discussed, and it is pointed out that the marked variations in its condition are chiefly due to the uneven distribution of the rainfall. The most serious deterioration takes place in the zones of medium and low rainfall. Insects seem to accelerate depletion, but the damage caused by them is only subsidiary to that due to other factors. Of the species found, those that feed on the leaves were more important than those that attack the roots. The former included the Noctuids, *Persectania composita*, Gn. (*ewingi*, Westw.), *Leucania toroneura*, Meyr., and *L. acontistis*, Meyr., which seemed to cause the most extensive damage, and the latter a Melolonthid of the genus *Odontria*.

A table based on the literature is given, showing the Lepidoptera that have been collected on tussock-land, the localities in which each species was taken, the frequency of its occurrence, the months in which the adults are present and, in some cases, the grasses or other plants on which the larvae fed. It appears that the habitat and food-plants of the majority are not known. The burning of the tussock to reduce the numbers of insects is not recommended, as this measure is in itself a primary cause of deterioration. The relation of birds found in the tussock-grasslands to the insect fauna is discussed.

HAMILTON (A.). **The New Zealand Dobson-fly (*Archichauliodes diversus* Walk.) : Life-history and Bionomics.**—*N. Z. J. Sci. Tech.* (A) 22 no. 1A pp. 44A–55A, 8 figs., 11 refs. Wellington, N.Z., 1940.

An account is given of investigations in 1930–31 on the life-history and ecology of the Megalopteron, *Archichauliodes diversus*, Wlk., which is widely distributed in New Zealand and of which the larvae

are of value as food for trout and other fresh-water fish. There is one generation annually, and the larvae occur in streams throughout the year. All stages are described.

DUMBLETON (L. J.). **Carpet Beetles Damage your Clothes.**—*N.Z. J. Agric.* **61** no. 4 pp. 282-284, 3 figs., 1 ref. Wellington, N.Z., 1940.

Notes are given on the bionomics of carpet beetles (*Anthrenus*), which are common and injurious to carpets, clothing, upholstery and other materials in New Zealand, together with a brief survey of measures for their control [*R.A.E.*, A **25** 83; **26** 400; **27** 187].

**Insect Pests and their Control.**—*Agric. Gaz. N.S.W.* **51** pt. 10 pp. 563-568, 8 figs. Sydney, 1940.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **29** 290] includes notes on the bionomics and control of the pasture grub, *Aphodius tasmaniae*, Hope (*howitti*, Hope) [*cf. 22* 447; **26** 209], which is particularly abundant in the Southern Tablelands in mixed improved pastures. A brief description is given of the adult of the Bostrychid, *Bostrychopsis jesuita*, F., the larvae and adults of which bore in various trees, including *Eucalyptus*, *Acacia*, silky oak (*Grevillea* sp.), white cedar (*Melia azedarach*), pepper tree (*Schinus molle*), apple, apricot, fig, lemon and orange. The infestation is not limited to dead or dying material, since apparently healthy orchard trees are attacked and killed. The adults have also been recorded boring into lead-covered aerial cables. The eggs are laid just below the surface of the bark, pupation takes place in a cell at the end of the tunnel and the adults emerge through exit holes in the bark. There is no ready means of control, but heavily infested branches should be cut off and burned and the cut surfaces painted with bluestone paint. One of the most troublesome of the fruit-tree moth-borers in the State is *Cryptophasa* (*Maroga*) *unipunctata*, Don., the habits of which are similar to those already recorded in Victoria [*cf. 21* 29; **22** 41]. The larvae of this Tineid have frequently been reported damaging shade and ornamental trees, and also attack cherry, peach and plum.

The results are given of experiments by W. L. Morgan on the control of tomato caterpillar [*Heliothis armigera*, Hb., and *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell. (*cf. 25* 296)]. The average percentages of infested fruits were 11 for weekly applications of a dust of lead arsenate and kaolin (1 : 2) and 14 and 22 for weekly sprays of 6 and 3 lb. lead arsenate in 40 gals. water. The addition to the sprays of nicotine sulphate (1 : 400), which is recommended for Aphid control, or of various spreaders and wetters, did not improve their effectiveness. Since it is necessary to spray weekly for disease and Aphid control on the early crops of the north coast, the best method seems to be to add lead arsenate to these sprays at the rate of 3 lb. to 40 gals. and to follow each application at an interval of 3 days with a dust of 1 part lead arsenate and 3 parts kaolin. The treatments have to be applied at regular and frequent intervals to destroy the newly hatched larvae on the blossoms and young fruits. The sprays should be applied over the whole plant, but the dust should be directed chiefly to the upper parts, especially the blossoms and young fruits.

HELY (P. C.). **The Citrus Red Scale Problem in New South Wales with special Reference to Fumigation.**—*J. Aust. Inst. agric. Sci.* **6** no. 3 pp. 140–146, 20 refs. Sydney, 1940.

A review is given of the methods that have been used for the control of *Aonidiella aurantii*, Mask., on *Citrus* in New South Wales since the end of the nineteenth century. Fumigation with hydrocyanic acid gas is now considered to afford the best control, and most commercial fumigation has been carried out since 1930 by means of calcium cyanide briquettes containing 85 per cent. calcium cyanide capable of liberating 10 grams HCN per tablet. These briquettes may become unobtainable owing to present conditions, and as there is also likely to be difficulty in procuring liquid HCN, it seems probable that the pot method, using sodium cyanide and dilute sulphuric acid, will come into use again. After a series of comparative experiments in different districts, it appeared that although slightly better scale kills were sometimes obtained with higher dosages, the standard rate for all fumigants should be in the vicinity of 6 gm. HCN per 100 cu. ft. For practical field purposes it should be adequate to utilise the standard briquette chart by reading 2 oz. Cyanogas, 1 (14 cc.) unit liquid HCN or 1 oz. sodium cyanide for each briquette required.

A survey of commercial fumigation was carried out during 1939 in the Murrumbidgee Irrigation Area to determine to what extent measurable factors were responsible for variation in scale kill under a wide variety of conditions, but the high natural mortality induced by the January heat wave masked the results to some extent. There was no clear correlation between percentage scale mortality and temperature, humidity, wind, time of treatment or size and shape of tree. An increase of 10 per cent. on the standard dosage rate (Calcid briquettes) gave no indication of improved results [*cf.* **28** 48]. Equally good results were shown when fumigation was carried out under conditions of high temperature and low humidity or at low temperatures and high humidity. Scale on mature Valencia orange fruits was not necessarily more difficult to kill than that on green fruit, though such mature fruit on trees did render the task of effective scale control much more difficult. Scales in the "grey adult" and second moult stages appeared to be more resistant to fumigation than those in other stages. On individual trees or groups of trees natural mortality due to high temperatures varied from 0 to almost 100 per cent., and variations in the percentage mortality due to fumigation were also observed on adjacent trees.

There has been a tendency to increase dosages in the hope of developing a treatment that will be effective for a longer period. Similar efforts in California have resulted in a combination of spraying with oil and fumigation [*cf.* **23** 107]. Recent experiments at Grafton showed clearly that even where drastic measures involving spraying and fumigation were adopted in winter on heavily infested trees, scale development in the late summer and autumn largely offset the advantages gained from the early treatments. Where summer treatments were introduced after early treatment, the results were highly satisfactory. Workers in Victoria have shown that the residual value of treatment in one year is important in the following season [*cf.* **28** 49], and that scale control measures must be determined on the basis of initial infestation. The best treatment for heavily infested trees is probably an oil spray in December followed by fumigation in

March. If infestation is sufficiently reduced in the following season, fumigation alone may be adequate.

Hydrocyanic acid gas is the most satisfactory fumigant available for the control of *A. aurantii*, but the spray materials are still capable of improvement, although any advantage obtained is dependent on the equipment available and the actual practice of spraying. The principle of programme treatments, modified as infestation fluctuates from season to season, offers the best solution to the problem.

ALLMAN (S. L.). **Foliage Poisons for the Queensland Fruit Fly (*Strumeta tryoni* Froggatt). The repellent Effect of Molasses.**—*J. Aust. Inst. agric. Sci.* **6** no. 3 pp. 154–160, 3 figs., 10 refs. Sydney, 1940.

An account is given of further laboratory work in New South Wales on bait-sprays for *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg. [*cf. R.A.E., A* **29** 54]. When unpoisoned sprays of molasses and cane sugar (4 and 2½ lb., respectively, in 4 gals. water) were applied to small areas on the glass top of the cage and allowed to dry, the flies showed a marked preference for the sugar. The substitution for 1 gal. of the water of 1 gal. of a syrup prepared by boiling 5 lb. apples in sufficient water to give 1 gal. liquid did not increase the attractiveness of the sugar, but it rendered the molasses more attractive, apparently by masking some of its repellent qualities. When the flies were offered no alternative to molasses, either alone or with apple syrup, no feeding was observed on the first day, and little occurred later until the flies were compelled to feed or starve.

As reluctance of the flies to feed on molasses might explain the apparent loss in toxicity of both sodium fluosilicate and lead arsenate when used with it [*cf.* **25** 165, etc.], feeding tests were carried out with sodium fluosilicate. The sprays tested contained 2 oz. poison in 4 gals. water, with the addition of 2½ lb. white sugar, alone or with 1 lb. hydrated lime, or of 4 lb. molasses. The mixtures containing hydrated lime and molasses were both almost completely ineffective, but it was not clear whether the molasses mixture was ineffective because it was repellent or because of the actual loss of toxicity of sodium fluosilicate possible in the presence of the lime salt in the molasses. It is evident, however, that molasses is not acceptable to this fruit-fly, and that its use in bait-sprays should be discontinued.

Further tests showed that the substitution of molasses for sugar also reduced the effectiveness against *D. f. tryoni* of bait-sprays containing tartar emetic. As molasses and tartar emetic have been found effective against other fruit-flies [*cf.* **24** 541], it seems unlikely that the reason for this lowering of toxicity is purely chemical. When tartar emetic and molasses was the only food available, considerable mortality was obtained by the end of six days, but when sugar was offered as an alternative, the mortality was negligible, again indicating that repellence and not loss of toxicity was responsible for the results. Tartar emetic was itself not repellent, since with tartar emetic and sugar a percentage mortality of 50 or over was first recorded on the second day, regardless of whether or not unpoisoned sugar was offered as an alternative.

**Termites in East Africa.**

HARRIS (W. V.). **I. General Biology.**—*E. Afr. agric. J.* **6** no. 2 pp. 62–66, 1 pl., 11 figs. Nairobi, 1940.

WILKINSON (H.). **II. The Biology and Control of Termites damaging Grassland.**—*T.c.* pp. 67–72, 1 pl.

The paper by Harris comprises a general account of the morphology and bionomics of termites and was intended as an introduction for a series dealing with the species that occur in East Africa. The second paper was received independently and incorporated in the series by the editor. The author states that Pole-Evans reported considerable destruction by both harvester and fungus-growing termites to vegetation and especially grass in three areas in Kenya, and specimens of harvester termites received from one area appeared to be similar to *Hodotermes mossambicus*, Hag. An extract is given from a paper by W. G. H. Coaton [*R.A.E.*, A **26** 48] on the habits and control of *Hodotermes* in South Africa [*cf.* **23** 377, 675].

The common fungus-growing termites known to be widely distributed in Kenya are *Termes transvaalensis*, Sjöstr., *T. badius*, Hav., *Macrotermes* (*T.*) *bellicosus*, Smeath., and *M.* (*T.*) *natalensis*, Hav., all of which are earth-dwelling species that may or may not build mounds, according to circumstances. Their habits are described at some length. The workers feed on cellulose, and since the termite population is considerable in vast areas in Kenya where trees and shrubs are virtually absent, decaying grass is probably their staple cellulose food. While it is more likely that dead or decaying grass and leaves are normally attacked, it seems unavoidable that in the absence of an abundance of such supplies they should attack the stubble and roots of grass. The damage is serious in years of drought.

It is known that the removal of the queen does not cause a colony to die out, because supplementary royalties can be developed, but the author has found that the removal of the queen, together with all the fungus gardens in the nest, causes the death of the colony. The fumigation of the nest by pumping in the hot fumes from a mixture of 3 parts white arsenic and 1 part flowers of sulphur burnt on charcoal in a small furnace has given excellent results, but the process may have to be repeated more than once. Fumigation with cyanogas calcium cyanide has been found only partly successful [*cf.* **15** 549], while fumigation with carbon bisulphide [**22** 627] is more effective during the rains, when the termites seem to concentrate in the nests, than during the dry season.

MOHAMMED FOUAD EL GAMMAL. **Hot Air Treating Machines used in the Ginneries for the Destruction of Pink Boll Worm in the Cotton Seed.**—*Bull. Minist. Agric. Egypt* no. 150, 20 pp., 40 pls. Cairo, 1940. Price P.T. 5.

As it has been shown that resting larvae of the pink boll worm [*Platyedra gossypiella*, Saund.] can be killed by exposure to a temperature of about 55–58°C. [131–136.4°F.] for not less than 5 minutes, the heat treatment of cotton seed immediately after ginning has been made compulsory in Egypt. Legislation issued between 1916 and 1926 prescribing the treatment and the equipment to use is briefly reviewed. The equipment comprises a machine treating the

seed by contact with metal heated by steam, some form of automatic temperature control, which is necessary because of the continual variations in the temperature in the machine due to variations in steam pressure and in the rate of flow of the seed, and a daily clock temperature recorder, so that a chart is made of the temperature of the seed at the outlet during the day. Fully illustrated descriptions are given of approved machines, temperature controls and recorders.

KLEIN (H. Z.) & PERZELAN (J.). **A Contribution to the Study of *Pseudococcus comstocki* in Palestine.**—*Hadar* **13** no. 4 pp. 107–110, 2 figs., 1 ref. Tel-Aviv, 1940.

The following is largely based on the authors' summary of this account of observations on *Pseudococcus comstocki*, Kuw., in Palestine, where it causes serious damage to *Citrus*, though its presence was not recognised until August 1937. In cases of severe attack, nearly half the seasonal crop was affected, and little or no blossom was produced in the following season. Under laboratory conditions the mealybug had seven generations a year, but in the groves in the coastal zone there are usually six. The complete development of a generation lasts 5–6 weeks in summer and up to 3 months in winter; the males mature somewhat before the females. The average and maximum numbers of eggs per female were 296 and 500; the oviposition period lasted about 14 days in summer and up to 60 in winter. Parthenogenesis does not occur. Females live for from five weeks to more than three months, according to season, while males survive for only a very short time. This mealybug is active and occurs on all parts of the tree. When blown to the ground, it at once tries to return to the tree. Investigations on banded trees showed that a maximum migration takes place at the end of April and during the first half of May and that the main trend of movement on the tree is from the top downwards. In the field, *P. comstocki* was found only on *Citrus*, all species of which appeared to be suitable food-plants. Under experimental conditions, it developed readily on potato sprouts grown in the dark. It was parasitised in the field by the Encyrtids, *Leptomastix flavus*, Merc., *Leptomastidea abnormis*, Gir., *Anagyrus pseudococci*, Gir., and *Isodromus* sp., and the Pteromalid, *Pachyneuron coccorum*, L., while the predacious Coccinellid, *Scymnus fenestratus*, Sahlb., frequently appeared in large numbers in association with it. It was not readily attacked under experimental conditions by the Hemerobiid, *Symphorobius amicus*, Nav., or *Scymnus quadrimaculatus*, Hbst., both of which are predacious on *P. citri*, Risso.

ZIRNGIEBL (L.). *Pamphilius sylvaticus* L., ein Obstbaumschädling. [*P. sylvaticus*, a Pest of Fruit Trees.]—*Verh. naturh.-med. Ver. Heidelberg* (N.F.) **18** pt. 3 pp. 207–222, 6 figs., 15 refs. Heidelberg, 1940.

*Pamphilius sylvaticus*, L., which occurs throughout the Palatinate, appears to be the only species of its genus that is likely to injure the foliage of fruit trees in Germany. The author states that a female taken on plum oviposited on the leaves in the laboratory and the resulting larvae completed their development in rolled leaves. He describes some characters of the larva, pupa and adult, and also the process of larval development of this sawfly.

SALT (G.). **Experimental Studies in Insect Parasitism. VII. The Effects of different Hosts on the Parasite *Trichogramma evanescens* Westw. (Hym. Chalcidoidea).**—*Proc. R. ent. Soc. Lond.* (A) **15** pt. 10–12 pp. 81–95, 3 figs., 11 refs. London, 1940.

In continuance of work on parasitism by *Trichogramma evanescens*, Westw. [*R.A.E.*, A **27** 35, etc.], a study was made of the ways in which the morphology, physiology and behaviour of the adults is affected by the Lepidopterous eggs in which they have developed.

The results are summarised as follows: The size of individuals is largely controlled by the size of the hosts in which they develop. The vigour, fecundity, longevity and rate of development of individuals are affected by their hosts. Through its effect on their size, the host influences the behaviour of females selecting hosts for their progeny. The host is one of the environmental factors that must be controlled in any quantitative work on *Trichogramma*.

PARKIN (E. A.). **The digestive Enzymes of some Wood-boring Beetle Larvae.**—*J. exp. Biol.* **17** no. 4 pp. 364–377, 37 refs. London, 1940.

The following is substantially the author's summary. Qualitative tests for the presence of amylase, invertase, maltase, lactase, cellulase, hemicellulases A and B, and proteinase in the digestive juices of wood-boring Coleopterous larvae are described. The larvae of 14 species representing Scolytids, Cerambycids, Lyctids, Bostrychids and Anobiids were investigated, and their nutrition is discussed in terms of the enzymes found and present knowledge of the composition of wood.

It is concluded that three types of wood feeding may be distinguished. Lyctids and Bostrychids are able to utilise only the cell contents and perhaps part of the polysaccharides which are intermediate in composition between starch and the hemicelluloses. Scolytids (bark-beetles) are able to utilise cell contents and the carbohydrates of the cell wall up to hemicelluloses, but excluding cellulose, while Anobiids and most Cerambycids can utilise cell contents and the carbohydrates of the cell wall including cellulose.

A proteinase is of general occurrence in the larval guts of wood-boring Coleoptera. Digestive enzymes were absent from the gut of hibernating larvae of *Scolytus scolytus*, F. (*destructor*, Ol.).

HINTON (H. E.). **The Ptinidae of economic Importance.**—*Bull. ent. Res.* **31** pt. 4 pp. 331–381, 59 figs., 5 pp. refs. London, 1941.

This comprehensive review comprises a key to the British species of Ptinids and those of economic importance elsewhere, descriptions of both sexes of each species, and notes on their distribution, habitats, synonymy and distinguishing characters.

VESEY-FITZGERALD (D.). *Melittomma insulare*, Fairm. (Col. Lymexylonidae), a serious Pest of Coconut in the Seychelles.—*Bull. ent. Res.* **31** pt. 4 pp. 383–402, 2 pls., 2 figs., 4 refs. London, 1941.

A detailed account is given of investigations on the bionomics and control of *Melittomma insulare*, Fairm., in the Seychelles, and the egg, pupa and adult of this Lymexylonid are described.

The following is substantially the author's summary. Now that Coccids have been controlled [cf. *R.A.E.*, A **29** 323], *M. insulare* is the most important pest of coconut in parts of Seychelles and is also very injurious in north-western Madagascar, where an unsuccessful search for natural enemies was made in 1939. In Seychelles, it occurs in only a few of the islands, its distribution depending on the original distribution of two indigenous palms, *Stevensonia* and *Nephrosperma*, which are its primitive food-plants. The eggs are laid under cover in groups of 100 or more and hatch in 11 days. The larvae feed in galleries in the base of the trunk for an indefinite period, depending on the sappiness of the wood, and pupate in the enlarged end of a boring. The adult is nocturnal and short-lived. The damage caused [cf. **26** 433] depends on the age and situation of the tree; other conditions being equal, trees on good soils suffer least. Several other species of insects are associated with *Melittomma*, but all are of minor importance.

Suggested remedial measures comprise earthing up the base of the trunk; incising attacked wood and painting the wound with tar; the application of a fumigant at the source of the larval air supply, though further experiments to determine a suitable one are necessary; and sanitary measures designed to destroy the major breeding centres.

MARSHALL (Sir G. A. K.). **New injurious Curculionidae (Col.).—***Bull. ent. Res.* **31** pt. 4 pp. 403–406. London, 1941.

The new species described are *Protoctrophus avidus*, feeding on young leaves of *Citrus* in the Transvaal, *P. salignae*, on seedlings of *Eucalyptus saligna* in Zululand, *Systates hargreavesi*, on *Markhamia platycalyx* (a timber tree) and coffee in Uganda, and *Myllocerus spinicollis*, on *Zizyphus jujuba*, and *Hyperstylus lineatus*, on leaves of apple, both in the Punjab.

THOMAS (J. G.). **The Relative Size of the Eye as a Phase Character in the African Migratory Locust.**—*Bull. ent. Res.* **31** pt. 4 pp. 431–433, 1 fig., 2 refs. London, 1941.

The relative size of the compound eye constitutes a good phase character in *Locusta migratoria migratorioides*, R. & F., the ratio of the length of elytron to the maximum vertical diameter of the eye (E/D) being over 15 in the males and about 16 in females of the gregarious phase, as against about 13 in the males and about 14.5 in the females of the solitary phase.

HUSAIN (M. A.), AHMAD (T.) & MATHUR (C. B.). **Studies on *Schistocerca gregaria* Forsk. X. Role of Water in the Bionomics of the Desert Locust.**—*Indian J. agric. Sci.* **10** pt. 6 pp. 927–944, 20 refs. Delhi, 1940.

The experiments described were carried out in India to elucidate the effect of humidity on different stages in the life-cycle of *Schistocerca gregaria*, Forsk. The technique of ensuring constant relative humidities in cages is discussed, and the need for distinguishing between physiological changes arising from deficiency of moisture in food and those caused by low atmospheric humidity is stressed.

Isolated hoppers kept at room temperature (average minimum 27.1°C. and average maximum 30.9°C. [about 80.1 and 88°F.]) and relative humidities of 45, 60 and 80 per cent., and fed 4 times a day

on fresh cabbage leaves introduced into the cages, all completed the last two instars in an average of about 19 days. Crowded hoppers kept at 36°C. [96.8°F.] and fed in a similar manner completed their larval development in an average of 22 days at both 35 and 85 per cent. relative humidity. In experiments in which no fresh leaves were introduced into the cages and hoppers kept at 36°C. were fed once a day outside the cages, the durations of development from the third instar to the adult stage did not differ greatly at 80 and 23 per cent. ; at both humidities it was longer than normal at this temperature, the delay being probably caused by undernourishment. When two pairs of adult locusts were kept at 30°C. [86°F.] and fed 4 times a day with fresh food, the female kept at 85 per cent. relative humidity dropped its eggs in 17 days, while the one kept at 35 per cent. relative humidity did so in 26 days. In a similar experiment at 35°C. [95°F.], the female kept at 86 per cent. relative humidity was ready to oviposit in 15 days and the one at 35 per cent. in 14 days. It is concluded that low atmospheric humidities do not delay hopper development [*cf.* *R.A.E.*, A **24** 228, 232] or inhibit or delay sexual maturation [*cf.* **22** 564 ; **24** 228], so long as the insects are able to obtain plenty of succulent food. High relative humidity does not favour long life in adults, which did not live for more than 16 days at 100 per cent. but survived for 70 days at 40 per cent.

The effect of moisture on oviposition and incubation was studied. Fully matured females did not oviposit into dry sandy soil, but when supplied with tubes filled with layers of moist and dry sand of different depths and in different orders, laid into the moist upper layer provided that it was not less than 2.6 ins. deep ; they also laid into the humid lower layer even when it was overlaid by a dry layer 3.6 ins. deep. Eggs were not laid into soil covered by water, but were deposited into waterlogged soil as soon as the surface water was drawn off. Newly laid eggs placed on lint in test-tubes and kept at temperatures between 25 and 37°C. [77 and 98.6°F.] did not hatch at relative humidities below 100 per cent. In a saturated atmosphere, they hatched in 11 days at 37°C. and about 32 days at 25°C. However, eggs that had already completed a third of their development hatched in 15 days at 90 and 100 per cent. relative humidity and in 17 days at 80 per cent. [*cf.* **18** 184 ; **24** 228]. To study the effect of deficient soil moisture on incubation, experiments were made with sand, loam, clay loam and clay. The technique of ensuring the exact measurement of moisture in the soil and maintaining constant conditions is described. Incubation lasted 12 days in saturated sandy soil at temperatures varying from 33 to 34°C. [about 92°F.], and 13 days at 31.2–34°C. [about 90°F.] in oven-dried sand to which 4.6 per cent. of water, by weight, was added. In sandy soil with maximum hygroscopic moisture exposed to fully saturated atmosphere, the eggs completed their development in 17 days at 33–34°C. and 23–25 days at 29–33.6°C. [about 88°F.]. However, in sand containing less than maximum hygroscopic moisture, development was arrested and recommenced only when the sand was moistened. In loam, on the other hand, development was completely arrested even when it contained maximum hygroscopic moisture. In loam containing maximum hygroscopic moisture plus 5 and 10 per cent. by weight of water, eggs hatched in 15–16 and 13 days, respectively. In clay loam and in clay containing maximum hygroscopic moisture, eggs remained unhatched but viable for 67 and 90 days, respectively, but on addition of water they perished

from fungous disease. In one case, however, eggs kept in clay loam containing maximum hygroscopic moisture remained dormant for 71 days, and then hatched in 10 days after 6.6 per cent. of water was added to the soil. This shows that in nature eggs could remain dormant and viable during prolonged drought and hatch after precipitation.

It appears that for normal development the eggs must not only be exposed to saturated atmosphere, but also be in contact with water which they can absorb. The eggs in the soil, like the root-hairs of plants, draw water from the film held round soil particles. The force with which this film is held depends on the size and nature of the particle. In sandy soil containing maximum hygroscopic moisture a slight fall of temperature would cause condensation of water from the air contained in the interspaces between soil particles, and make it available to the eggs. In finer soils containing maximum hygroscopic moisture, the water is held too firmly to be easily absorbed by the eggs, and the addition of free water is needed before they can develop, the amount of water required increasing with the heaviness of the soil.

CHERIAN (M. C.) & MAHADEVAN (V.). **The Wax Beetle—*Platybolium alvearium*, B. in South India.**—*Madras agric. J.* **28** no. 6 pp. 210–212, 2 refs. Madras, 1940.

A Tenebrionid found in August 1937 in hives of the Indian honey bee [*Apis indica*, F.] at Coimbatore was subsequently described by K. G. Blair (1938) as *Platybolium alvearium*, gen. et sp. n. Blair's description of the adult is quoted, and the immature stages are briefly described.

The adults deposit their eggs in groups in crevices between the brood chamber and the base board or between the super and the brood chamber. The larvae hatch in 4–5 days and feed on the particles of wax on the floor-board. Larvae fed on pollen removed from food materials stocked in combs developed much more quickly than those fed on wax, the periods required to reach the pupal stage averaging 39 and 112 days, respectively. The pupal stage lasted 6–7 days, and the adults survived for averages of 148 and 43 days when fed on wax and pollen, respectively. Starved adults all died in 18 days, and those given ground cholam [*Sorghum*] in a month.

Larval feeding is confined to crumbs on the floor of the hive, but the adults feed on the combs and bore into the cells. The extent of the damage caused varies with the intensity of the infestation. The beetles are present almost throughout the year, but cause little damage to strong colonies. From the examination of a large number of hives it is concluded that *P. alvearium* is a minor pest of bee colonies, although it is capable of damaging stored combs and those kept in hives without bees.

Suggested control measures include the weekly cleaning of hive floor-boards and the removal of the adults by hand.

LIZER Y TRELLES (C. A.). **Catalogo sistemático razonado de los Cóceidos ("Hom. Sternor.") vernáculos de la Argentina.** [A Catalogue of the native Coccids of Argentina.]—*Physis* **17** pp. 157–210. Buenos Aires, 1939.

This catalogue of the Coccids indigenous to Argentina includes a general review of the distribution and food-plants of the various

species or groups of species and the types of country in which they occur, records of the regional occurrence and food-plants of each species individually, with notes on the synonymy and parasites of some of them, and indices to the Coccids, food-plants and parasites.

BLANCHARD (E. E.). **Apuntes sobre Encértidos argentinos.**—*An. Soc. cient. argent.* **130** no. 3 pp. 106–128, 8 figs. . Buenos Aires, 1940. (With a Summary in English.)

This is the first part of a paper on new Encyrtids, most of which have been reared from Coccids in Argentina. It includes keys to the females of 16 new species, of which 9 belong to 8 new genera, and to the males of 3 others, of which 2 belong to new genera. Only 8 of them are described in this part, viz.: *Acerophagoides triangularis*, gen. et sp. n., and *Protanagyrus aciculatus*, gen. et sp. n., both reared from unidentified Coccids, possibly belonging to the genus *Eriococcus*; *Coccidaphycus nigricans*, gen. et sp. n., from *Tachardiella argentina*, Dom., *Neocoelostoma xerophila*, Hemp., and *Lecanium deltae*, Lizer; *Eucomys littoralis*, sp. n., from *Pulvinaria convexa*, Hemp.; *Leptomastidea brethesi*, sp. n., from *Pseudococcus* sp. on *Acacia*; *Xenocomys chrysomphali*, sp. n., from *Chrysomphalus lahillei*, Lizer; *Microterys elegans*, sp. n., from *Ceroplastes* sp. and *Saissetia oleae*, Bern.; and \**Neocopidosoma coccidophaga*, gen. et sp. n., from *Icerya* sp. on mandarin orange.

FONSECA (J. P.) & AUTUORI (M.). **Processos de criação da “Vespinha Africana” parasita da “Môsea do Mediterrâneo.”** [Methods for Breeding *Tetrastichus giffardianus*, a Parasite of the Mediterranean Fruit Fly.]—*Biologico* **6** no. 12 pp. 345–351, 8 figs. São Paulo, 1940.

Twelve examples of *Tetrastichus giffardianus*, Silv., a Eulophid parasite of *Ceratitis capitata*, Wied., were imported into Brazil by air in August 1937. Eight were caged with larvae of *Anastrepha* and failed to reproduce, but the others readily parasitised larvae of *C. capitata* in coffee berries and had given rise to 34 generations by the end of 1940. Over 500,000 individuals were distributed, and the Eulophid has become established. For the benefit of fruit growers, instructions for breeding this parasite on a small scale are given, together with descriptions of all stages of *C. capitata* and characters distinguishing the adults from those of indigenous fruit-flies, on larvae of which it cannot be reared. Breeding should be done in a well ventilated dry room with a temperature of 22–25°C. [71·6–77°F.], and the boxes used should have two or three sides of metal gauze and the rest of glass and contain trays on which fruits infested by *C. capitata* can be placed. The adult parasites are released in the box, and the resulting larvae pupate in sand on a tray at the bottom of it. The pupae are transferred by means of a fine paint brush to tubes, and the adults are either liberated in orchards or, if kept for further breeding, fed on diluted honey.

\* This name has already been given to an Encyrtid genus by Ishii in 1923. Bull. Dep. Agric. & Comm. imp. Pl. Quar. Sta. Japan no. 3 p. 101.—Ed.

FONSECA (J. P.). **Perfuração da capa de chumbo de condutores elétricos por pequenos insectos.** [The Perforation of the Lead Sheathing of Electric Cables by small Insects.]—*Biologico* **6** no. 12 pp. 372–373. São Paulo, 1940.

Several cases of injury by insects to the sheathing of electric cables have been recorded in Brazil [cf. *R.A.E.*, A **23** 121]. In 1938, the lead sheathing of aerial telephone cables in Recife was perforated by a Cerambycid, *Megaderus stigma*, L., which was presumably breeding in a timber yard nearby. Bostrychid beetles of the genus *Micrapate* (*Bostrychulus*) were recently observed causing similar injury to telephone cables.

SCOTT (L. B.). **The Bean Pod Borers in Puerto Rico.**—*J. Agric. Univ. Puerto Rico* **24** no. 2 pp. 35–47, 2 figs., 3 refs. Río Piedras, P.R., 1940.

An account is given of investigations carried out in Porto Rico from July 1935 to October 1936 on the Pyralid bean-pod borers, *Maruca testulalis*, Geyer, *Etiella zinckenella*, Treit., and *Fundella cistipennis*, Dyar. They occurred throughout the Island and were particularly numerous in the lowlands near the coast where beans were abundant. Contrary to previous observations [cf. *R.A.E.*, A **22** 153], *Maruca* was the most abundant and injurious and in some cases destroyed whole fields of beans. The peak infestation occurred in October. It was essentially a pest of cultivated beans, although it was frequently found infesting *Crotalaria incana* and *Canavalia maritima*, which grows wild on most of the beaches in Porto Rico, and also occurred in *Vigna unguiculata*, a cowpea that is both cultivated and wild. *Etiella* was present in at least moderate numbers throughout the year, although it was less numerous in the dry winter months; it occurred in numbers in all types of cultivated beans [*Phaseolus*], but was far commoner in pods of wild leguminous plants, particularly *C. incana* [cf. **23** 113]. *Fundella*, which was the least numerous, was also present throughout the year, but its numbers were greatly reduced during the winter, when green beans are exported to the mainland. Its favourite food-plant was *V. unguiculata*, though it also occurred in lima beans, which were never severely infested, and in pods of *Canavalia maritima*, *C. ensiformis* and a wild shrub, *Ditremena* (*Cassia*) *occidentalis*. No infestation by the Pyralids was observed in *Crotalaria retusa*, *C. stipularia*, wild lima beans, or several leguminous trees, but *Tephrosia vogeli* was moderately infested by *Etiella*.

Experiments on control showed that infestation of bush beans was reduced by over 90 per cent. by two applications of a dust containing 80 per cent. natural cryolite or potassium fluoaluminate at the rate of 25 lb. per acre; the first application was made when many blossoms and small pods were present and the second when most of the pods were full grown but still green. Both dusts left an objectionable residue and should not be applied to parts of the plants that are to be marketed or consumed by domestic animals. Similar applications of pyrethrum dust containing 0.9 per cent. pyrethrins were moderately effective, but the cost was prohibitive. Dusts and sprays containing rotenone gave inferior results.

The decided preference of the borers for the hairy pods of *Crotalaria incana* and their avoidance of wild lima beans suggested that certain cultivated varieties of lima bean might be more susceptible to

infestation than others. The preliminary results of experiments with 17 varieties indicated that those having small seeds, particularly the variety Carolina, were decidedly more resistant than those having large ones.

PLANK (H. K.) & SMITH (M. R.). **A Survey of the Pineapple Mealybug in Puerto Rico and Preliminary Studies of its Control.**—*J. Agric. Univ. Puerto Rico* **24** no. 2 pp. 49–76, 6 figs., 11 refs. Río Piedras, P.R., 1940.

The results are given of a field survey and subsequent studies on the control of the pineapple mealybug, *Pseudococcus brevipes*, Ckll., carried out in Porto Rico in 1936. Infestation of pineapples is thought to have increased of recent years, and in some formerly highly productive areas there cultivation has been abandoned on account of damage by this Coccid.

The observations were made on six plantations, and of the 204 plants examined, 86.3 per cent. were infested. On two plantations all the plants examined were infested, and the lowest percentage infestation on any one plantation was 66.7. All parts of the plant were attacked. Heavily infested plants were usually stunted and chlorotic and often wilted, and the leaves were much reduced in size. As the plants grew older, the injury became intensified, and they assumed a sickly, dusty appearance suggestive of the symptoms of pineapple wilt in Hawaii [*cf. R.A.E., A* **25** 743, etc.]. The size, quality and yield of fruit was seriously reduced.

The mealybug has already been recorded in Porto Rico on 7 plants other than pineapple, and a list is given of 18 further plants on which it was observed by the authors. These include avocado, sweet maize and sweet potato. It appears that certain grasses and weeds in or near a pineapple field can serve as reservoirs of infestation.

*P. brevipes* was seldom unattended by ants. A list is given of the 16 species found associated with it, together with brief notes on some of them. By far the most important was *Solenopsis geminata*, F. Three species, including *S. geminata*, were frequently seen carrying young mealybugs about in the fields. Although all the ants listed have predacious habits, the principal food of nearly all of them is the honey-dew of the mealybug and other insects. The larvae of a Tineid, a Pyralid and a Cecidomyiid, all found living in the waxy secretions round large groups of mealybugs, were probably predacious on them, while one of two recently introduced Encyrtid parasites has become established [**28** 523, 524].

In investigations on methods of freeing planting slips from infestation, the technique of which is described in detail, batches of about 100 heavily infested slips were submerged in tap water for 72 or 96 hours or kept for 6 hours in a saturated atmosphere at about 115°F. They were planted on the day after treatment and kept free from ants, and counts of mealybugs were made 6 weeks later. The percentages of slips that survived the treatments were 74.5, 44.1 and 100, respectively, and 8, 4.4 and 10.5 per cent. of them were still infested; the percentage mortalities of the mealybugs as compared with untreated slips were about 92, 99 and 98, and the numbers of mealybugs per infested slip averaged 5, 1 and 1. When ants were allowed access to the planted slips, the percentage infested increased somewhat owing to dissemination of the mealybugs. Recommendations for

the control of *P. brevipes* include clean cultivation in and around pineapple fields; the avoidance of grassland for new fields; the destruction of all mealybug food-plants, especially old pineapple stumps, and colonies of ants prior to replanting old fields; and, if necessary, the use of a leguminous cover crop to prevent a fallow field from becoming weedy before replanting. The use of clean planting slips is of primary importance.

BALCH (R. E.) & PREBBLE (J. S.). **The Bronze Birch Borer and its Relation to the Dying of Birch in New Brunswick Forests.**—*For. Chron.* **16** no. 3 pp. 179–201, 7 figs., 2 graphs, 27 refs. Quebec, 1940.

*Agilus anxius*, Gory, occurs on birch (*Betula*) throughout most of the range of this tree in Canada and the United States, and has not been recorded from any other country. It has been reared from almost all species of birch and poplar (*Populus*) indigenous to Canada, as well as from the European *B. alba*, but most of the records refer to infestation of ornamental trees. Since about 1935, however, yellow, white and grey birch (*B. lutea*, *B. papyrifera* and *B. populifolia*) in forests in central and southern New Brunswick have been dying in large numbers from the top downwards and the symptoms were typical of damage by *A. anxius* [*cf. R.A.E.*, A **22** 135]. Preliminary investigations in the summer of 1938 showed that the Buprestid was present in all of a small number of birches showing injury, and its galleries completely girdled the dead or dying branches and stems. In most cases the purely mechanical injury was sufficient to ensure the death of the whole cambium area of the parts attacked. In 1939, about 20 per cent. of the trees were dead in stands of mature yellow birch and in 35 per cent. over half the crown was dead. Young stands were much less severely injured. Virgin stands showed almost as much damage as cut-over land. The injury has also recently become noticeable in northern Maine.

Observations on the life-history of this Buprestid in 1939 showed that adults from caged logs emerged throughout July, with a few stragglers as late as the middle of August. Since newly hatched larvae were found on 12th July, however, emergence must have begun before the end of June. Caged adults paired soon after emergence and lived for an average of 23 days. They fed on foliage of poplars and birches, with a preference for *P. tremuloides*, followed by *B. lutea*, but not more than about one leaf per beetle was eaten. They accepted willow leaves only when birch was not available. The eggs are laid in small groups, and several larvae may start boring from the same point, making their way fairly directly through the bark to the cambium, where most of the feeding takes place. While young larvae need living cambial tissue, development of the final stages to pupation occurs only if the part attacked is dead or moribund. A normal and apparently healthy tree of almost any age may be attacked, and the larvae develop in it to a half-grown stage. If there are enough of them to kill the branch at this stage, they may complete their development, but if the attack is too light for this, galleries heal over and the normal growth of the tree is gradually resumed. Such unsuccessful attacks may be repeated several times in one tree.

Infestation occurs chiefly in mature or overmature trees or trees in which some other factor has seriously reduced the vigour of the

part attacked. In the presence of an abundance of such material, the beetle is capable of increasing and consequently attacking greater numbers of healthy trees. Causes that may have contributed to the present situation in New Brunswick are the presence of large areas of mature and overmature stands; the damage to birch from exposure following the felling of conifers or their destruction by the spruce bud worm, *Harmoloba (Cacoecia) fumiferana*, Clem.; and the repeated and widespread defoliation of birch during the past twelve years by *Phyllotoma nemorata*, Fall., *Fenusa pusilla*, Lep. (*pumila* Klug) and *Bucculatrix canadensisella*, Chamb. Prevention of the injury depends on eliminating overmature stands and maintaining vigour of growth. Severe thinning or leaving birch on cut-over lands should be avoided.

WILFORD (B. H.). **The Seed-corn Maggot, a Pest of Red Cedar Seedlings.**—*J. For.* **38** no. 8 pp. 658-659. Washington, D.C., 1940.

*Hylemyia cilicrura*, Rond., which is usually considered a pest of field crops in the United States, although it has been recorded from roots of larch, acorns and peach seedlings, caused considerable injury to young seedlings of red cedar (*Juniperus virginiana*) in a nursery in Tennessee in 1937 and 1938. In both years the damage was caused in May to seedlings sprouting from seed sown about three months previously. In the South Central States, this Anthomyiid is believed to hibernate in the prepupal or pupal stage in the soil. The adults emerge in April, and the females oviposit in moist soil treated with organic fertilisers [*cf. R.A.E., A 29 158*]. There are at least two generations a year, but the second occurs too late to be destructive to the young red-cedar seedlings. Early symptoms of damage comprise a generally unhealthy appearance, followed by wilting and yellowing of the stems at and above ground level. The larvae attack the roots or bore through the thin bark of the stem just below the surface of the ground. If the tap root is uninjured, adventitious roots develop and the plant may recover.

It was considered that injury might be avoided by late planting, the substitution of inorganic for organic fertilisers and their application in autumn before planting or after the seedlings are  $1\frac{1}{2}$ –2 ins. above the ground. In 1939, the seedbeds were prepared during the winter and seeded in March, and no fertilisers were used. As a result, there was no injury by *H. cilicrura*. It was apparent that screen covers afford no protection against infestation unless the soil is free from overwintering insects, since these will emerge and reproduce within the covers. Preliminary tests indicated that 50 per cent. carbon bisulphide emulsion diluted to a concentration of 0.25 per cent. carbon bisulphide and applied to the soil at the rate of 1 U.S. pint liquid per sq. ft. when the larvae are feeding gives good control and does not damage the seedlings.

**List of intercepted Plant Pests, 1939.**—*S.R.A., B.E.P.Q.* [1939] 53 pp. Washington, D.C., U.S. Dep. Agric., 1940.

This list of pests intercepted between 1st July 1938 and 30th June 1939 with plants or plant products entering United States territory (including Hawaii and Porto Rico) resembles the preceding one [*R.A.E. A 28 222*] in the selection and arrangement of the data. It includes

pests on products that were imported, offered for but refused entry, held as ship's stores, etc., and hence not imported through customs, or offered for entry for immediate export or for immediate transportation and exportation in bond, and in domestic shipments reaching the mainland from Hawaii and Porto Rico. Notes on insects of particular interest are arranged in two sections, dealing, respectively, with fruit-flies and insects other than fruit-flies, and the interceptions are summarised according to continents. The main part of the report consists of a list arranged by country of origin of the intercepted pests, showing the food-plants or materials on which they were taken, the number of interceptions made, and the States in which the collections were made. Common and incompletely determined pests are omitted but are summarised in separate short paragraphs, and a list of fungi attacking some of the pests is given.

**Service and Regulatory Announcements, October-December 1940.**—*S.R.A., B.E.P.Q.* no. 145 pp. 85-102. Washington, D.C., U.S. Dep. Agric., 1941.

Information in this part includes a summary of plant quarantine restrictions in Chile and an amendment to a summary already noticed of restrictions in British India.

BUGHER (J. C.). **A Micromortar especially adapted to Virus Studies in Insects.**—*Proc. Soc. exp. Biol.* **43** no. 2 pp. 422-424, 1 fig. New York, N.Y., 1939. [Recd. 1941.]

A description is given of a pestle and mortar made of pyrex glass and designed to triturate insects with the minimum loss of material.

BOYCE (A. M.), KAGY (J. F.), McCALL (G. L.) & LADUE (J. P.). **Black Scale Control. Summary of Studies with low Dosages of Oil with Rotenone-bearing Materials.**—*Calif. Citrogr.* **25** no. 10 pp. 314, 342-344. Los Angeles, Cal., 1940.

An account is given of work carried out in California in view of the desirability of developing effective sprays including not more than 0.5 per cent. light-medium oil, or none at all, for the control of *Saissetia oleae*, Bern., and *Coccus pseudomagnoliarum*, Kuw., on *Citrus*. It is probable that the maximum effectiveness of rotenone-bearing materials, which are incorporated with oil applied at concentrations of 0.5-1.0 per cent. in several proprietary sprays now being used against *S. oleae*, is not obtained when the powdered root is added to an oil emulsion, since the toxic principles are practically insoluble in petroleum oil or water. It was considered that a true solution of the toxic principles in petroleum oil would result in increased effectiveness and permit a reduction in the concentration of oil, and investigations were therefore carried out on intermediary solvents [*cf. R.A.E.*, A **26** 574; **28** 617]. Some of the most promising were tested in the field in 1938 and 1939, and the results of several of the experiments, which were carried out on *S. oleae*, are given.

The sprays used in 1938 contained 0.25 per cent. light-medium oil and 0.125 per cent. of a solution of 10 per cent. derris resins (25 per cent. rotenone) in four intermediary solvents, blood albumin spreader

being added at the rate of 4 oz. per 100 U.S. gals., except in one case, and were compared with 1.66 per cent. oil with the spreader (the normal treatment). The percentage survivals in one grove averaged 5.1 for the spray without derris resins, 3.4 and 2.5 when the intermediary solvents for them were 2 (4-tertiary butylphenoxy) ethanol (also called paratertiary butylphenoxy ethanol and designated K-58), which was used without spreader, and dibutyl phthalate, respectively, and 14.4 and 13.8 when they were di-isobutylketone and methyl-n-amylketone; and in another they averaged 1.5, 1.2 and 4.1 for the first three, respectively. Di-isobutylketone is a relatively poor intermediary solvent, since a liquid phase separates when the solution of derris resins is added to the oil and the resins exist in the oil as a suspension rather than as a true solution, while the other ketone is so soluble in water that a large portion of it and the resins enter the water phase of the spray mixture. Significantly better results were obtained with the other two intermediary solvents, which gave true solutions of the resins in the oil.

In 1939, the efficiency of powdered derris root (5 per cent. rotenone) incorporated with oil was compared with that of derris resins in solution in oil, and the effect of the powdered lignocellulose solids on the quantity and character of the oil deposited from the former was tested by the addition of exhausted derris root or comparable amounts of walnut-shell flour to some of the sprays. Oil was used at a concentration of 0.5 per cent. in sprays containing powdered derris root and 0.25 per cent. in those containing derris resins. It contained 1 per cent. glyceryl monooleate as emulsifier in all sprays except those in which K-58 was used together with exhausted derris or walnut-shell flour. The average percentage survivals of *S. oleae* were: 13.9, 0.6 and 8.6 for sprays of 0.5 and 1.66 per cent. oil alone, and 0.5 per cent. oil with 1 lb. exhausted derris root per 100 U.S. gals., respectively; 1.4 for  $\frac{1}{2}$  lb. exhausted derris root with  $\frac{1}{2}$  lb. normal derris root per 100 U.S. gals.; 0.9 for 1 lb. normal derris root; 0.5 for an equivalent amount of rotenone in the form of a 0.0625 per cent. solution of 16 per cent. derris resins in K-58; 0.8 when 1 lb. exhausted derris root or walnut-shell flour was added to this; and 0.7 for a 0.125 per cent. solution of 8 per cent. derris resins in dibutyl phthalate with the addition of 4 oz. soda ash (sodium carbonate) per 100 U.S. gals. When 1 lb. exhausted derris or walnut-shell flour was substituted for the soda ash in the last spray, however, the percentage survival was increased to 3.1 and 2.0, respectively.

When the quantity of extractives from the powdered derris was increased in further tests by digesting the root at about 80°C. with K-58 before dispersion in the oil, the control was as good as that obtained with derris resins in K-58. The latter gave nearly as good control as did sprays containing oil at the normal concentration or fumigation with hydrocyanic acid gas, but was less reliable and is not recommended for use on heavy infestations or on very smutty foliage. Low concentrations of oil with rotenone were more effective against the larger adults than oil at the full concentration; the incidence of navel water spot was significantly less than on trees receiving the normal concentration [cf. 25 38] and was only slightly greater than on others that were fumigated. K-58 is better than dibutyl phthalate, since it is also an excellent emulsifying, wetting and spreading agent and only about half the quantity is needed to render a given amount of derris resins soluble in oil.

BURKHOLDER (C. L.), JOHNSON (D. L.) & FORD (O. W.). **Two Years Results with Codling Moth Sprays.**—*J. econ. Ent.* **33** no. 5 pp. 713–717, 1 ref. Menasha, Wis., 1940.

The following is based on the authors' summary of experiments in part of an orchard containing 70 acres of mature apple trees and situated in the section in Indiana where the codling moth [*Cydia pomonella*, L.] has three generations a year and where a combined attack of late second-generation and third-generation larvae has proved very difficult to control between 10th August and harvest. When more than four first-brood cover sprays of lead arsenate and oil have been applied in this orchard, spray injury to foliage and fruit has been severe. Four cover sprays have given good commercial control in recent years, but the success of such a programme is believed to depend on the size of the moth population, pruning to facilitate coverage of the upper part of the tree, and supplementary control measures, especially packing-shed sanitation. In a partly isolated 15-acre block, a commercially prepared nicotine-bentonite combined with a small quantity of oil gave good control, but required more frequent application than sprays of lead arsenate and oil. A schedule in which sprays of nicotine-bentonite and oil against the first generation were followed by one or two sprays of lead arsenate and oil during the latter part of the period of fruit development, when lead arsenate is extremely effective, gave satisfactory control and caused negligible foliage injury. The deposits of lead and arsenic were determined before and after spraying and at harvest, and showed that it is possible to obtain a heavy and effective film of lead arsenate by means of one spray applied after the apples have reached a size of 7–10 fruits per lb. Tests conducted during two seasons showed that a rapid washing treatment at packing-shed temperature removed a high percentage of the residue and reduced the deposits of both arsenic and lead to within tolerance [*cf. R.A.E.*, A **28** 362].

DAWSEY (L. H.) & MARKWOOD (L. N.). **Supplementary Spray Materials for Use with Nicotine Peat.**—*J. econ. Ent.* **33** no. 5 pp. 717–722 1 fig., 7 refs. Menasha, Wis., 1940.

The following is based on the authors' introduction and summary. In response to recent demands for insoluble nicotine insecticides able to withstand weathering, attempts have been made to prepare combinations of nicotine that are more persistent than the sulphate or the free alkaloid. Nicotine peat [*cf. R.A.E.*, A **26** 24, etc.] is an insecticide in which the solubility of the nicotine in water is reduced, though not completely eliminated; at the usual spray strength about 90 per cent. of the nicotine is insoluble. A small-scale investigation was made of nine supplementary materials for use as adhesives in conjunction with sprays of nicotine peat; the only one that gave satisfactory results was bentonite. The sprays were applied to potted rose bushes, and the factors considered in evaluating them were physical distribution of the spray residue, quantity and persistence of the nicotine deposits and phytocidal effects. Bentonite was also tested as an adhesive for nicotine sulphate, and the results obtained with this spray were slightly superior to those with bentonite and nicotine peat.

DAWSEY (L. H.) & MARKWOOD (L. N.). **Persistence of Nicotine on Rose Bushes sprayed with Nicotine Sulphate Combinations.**—*J. econ. Ent.* **33** no. 5 pp. 722–723, 1 fig., 1 ref. Menasha, Wis., 1940.

The results are given of investigations on the density and uniformity of the initial deposit of nicotine given on rose bushes by four sprays containing nicotine sulphate and its persistence on the foliage (determined at weekly intervals). On all criteria of performance the order of efficiency of the sprays was: nicotine-bentonite with soy-bean oil; nicotine-bentonite alone [*cf.* preceding abstract]; nicotine sulphate alone; and nicotine sulphate with molasses.

SMITH (C. F.). **Toxicity of some nitrogenous Bases to Eggs of *Lygaeus kalmii*.**—*J. econ. Ent.* **33** no. 5 pp. 724–727, 6 figs., 10 refs. Menasha, Wis., 1940.

The following is based on the author's summary of a laboratory investigation of the toxicity of certain nitrogenous bases to the eggs of *Lygaeus kalmii*, Stål. Concentration-mortality curves are presented for solutions of the bases tested and for sodium oleate, which was used with them at a concentration of 0.25 per cent. as a spreading and wetting agent. The equations of the regression lines for each compound were determined by the method of Bliss [*R.A.E.*, A **23** 493], and the data were analysed statistically. The median lethal concentrations (expressed as percentages) were 0.11 for nicotine, 0.12 for quinoline, 0.18 for anabasine, 0.29 for piperidine, 19.6 for pyridine, and 2.0 for sodium oleate. The difference in toxicity between nicotine and quinoline was not significant. Quinoline killed the eggs at once, but with the other five compounds the development of the embryos continued for several days. In some cases the nymphs were able to hatch, but died soon afterwards.

FISHER (R. A.). **Insecticidal Action of Extracts of *Veratrum viride*.**—*J. econ. Ent.* **33** no. 5 pp. 728–734, 3 figs., 9 refs. Menasha, Wis., 1940.

American hellebore (the rhizome of *Veratrum viride*) was formerly used in powdered form as an insecticide, with varying degrees of success, but its use has declined in recent years, probably on account of insufficient knowledge of its active constituents. Details are given of investigations on the alkaloids extracted from it by various processes; the results show that certain extracts possess considerable toxicity to several species of insects, either as stomach or as contact insecticides. Results of tests with the powder itself, however, were generally poor, since the toxic alkaloids are present in proportions too small to be effective. For general insect control, it appears to be necessary to extract the alkaloids and employ them in a more concentrated form; with the perfection of practical methods of extraction, it is possible that this drug can become economically important as a source of insecticide material.

The alkaloids in the drug may be separated roughly into two fractions, one soluble in ether and the other insoluble in ether, but soluble in chloroform. The ether-soluble alkaloids possess considerable toxicity, being approximately five times as toxic to *Periplaneta americana*, L., as arsenic trioxide. The ether-insoluble alkaloids

were not toxic to any of the insects on which they were tested, and standardisation of the drug should, therefore, be based on the fraction of alkaloids soluble in ether and not on the total alkaloid content. Water apparently extracts the same alkaloids from the drug as does ether, since the water-soluble alkaloids were as toxic to *P. americana* as were the ether-soluble alkaloids from the same sample of powder. Aqueous extracts, however, had no effect on Aphids (*Aphis rumicis*, L., and *Myzus persicae*, Sulz.).

HANSBERRY (R.) & NORTON (L. B.). **Toxicities of optically active Nicotines and Nornicotines to *Aphis rumicis*.**—*J. econ. Ent.* **33** no. 5 pp. 734–735, 1 fig., 8 refs. Menasha, Wis., 1940.

The following is the authors' summary. Toxicity studies in the laboratory of a group of optically active nicotines and nornicotines and of *dl*-nornicotine gave the following order of toxicities against *Aphis rumicis*, L.: *l*-nornicotine, *dl*-nornicotine and *d*-nornicotine were almost equally more toxic than *l*-nicotine; *d*-nicotine was substantially less toxic than *l*-nicotine.

BRONSON (T. E.) & DUDLEY jr. (J. E.). **Peanut Oil in Derris Dust Mixtures against the Pea Aphid.**—*J. econ. Ent.* **33** no. 5 pp. 736–738, 1 ref. Menasha, Wis., 1940.

The results of experiments carried out during 1938 and 1939 in the greenhouse and in the field against *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) on peas indicated that the effectiveness of derris dust mixtures is increased appreciably by the addition of small quantities of crude ground-nut oil. All the dusts used in the greenhouse tests contained 0.4 per cent. rotenone. At temperatures of 60–70°F., a dust of derris and talc and a similar dust conditioned with 1 per cent. sodium oleyl sulphate and 2 per cent. water were ineffective at relative humidities of 20–59 per cent., and only moderately effective at 60–79 per cent., whereas a derris-talc dust conditioned with 1 per cent. sodium oleyl sulphate, 2 per cent. crude ground-nut oil and 0.5 per cent. water, previously emulsified together, was moderately effective at the lower range of humidity and very effective (96.4 per cent. mortality) at the higher one. In further greenhouse tests with these dusts and one of derris and talc conditioned with 2 per cent. crude ground-nut oil alone, at temperatures of 58–72°F. and relative humidities of 30–62 per cent., both the dusts containing ground-nut oil were highly effective, whereas the others were only moderately so.

The field tests were carried out with dusts containing 0.75 per cent. rotenone, conditioned as in the first greenhouse experiment, under varying conditions of temperature and humidity, and the average reductions in infestation were computed at intervals for 16–17 days after application. In 1938, when 3 dusts were tested, the one containing ground-nut oil was consistently superior to that conditioned with sodium oleyl sulphate alone and to the unconditioned dust, while in 1939, when only two were tested and conditions were favourable for Aphid mortality, it gave better results than the other dust containing sodium oleyl sulphate on 5 of the 6 days on which counts were made.

HOLLOWAY (T. E.) & MATHES (R.). **The Amazon Fly, *Metagonistylum minense*, a Parasite of the Sugarcane Borer.**—*J. econ. Ent.* **33** no. 5 pp. 738–742, 4 refs. Menasha, Wis., 1940.

The following is based on the authors' summary. Mated females of the Amazon river and São Paulo (dry-land) strains of *Metagonistylum minense*, Tns. [cf. *R.A.E.*, A **29** 4], introduced for the control of *Diatraea saccharalis*, F., on sugar-cane, were received in Louisiana from Porto Rico in May 1938 and May 1939, respectively, and were dissected to obtain the larvae, which were bred in larvae of *D. saccharalis* in the stems of sugar-cane or maize [cf. **28** 94, 651], or on shavings of sugar-cane or maize in shallow pans [**28** 240]. The highest number of flies obtained from 100 inoculated borers was 165, but the average was much lower. Large, fully-fed borers were found to be best for most purposes. Nine generations of the Amazon strain were produced in 1938, and six of the São Paulo strain in 1939, when production was reduced by an invasion of parasitic mites. The numbers of flies reared and liberated, respectively, were 3,612 and 1,222 in 1938, and 3,217 and 1,904 in 1939. Flies of both strains were recovered soon after their release, and it was found that a considerable number of borers had been destroyed. Flies originating from the 1938 releases were taken in the same vicinity in 1938.

POOS (F. W.). **The Locust Leaf Miner as a Pest of Soybean.**—*J. econ. Ent.* **33** no. 5 pp. 742–745, 1 fig., 10 refs. Menasha, Wis., 1940.

In July 1939, soy beans grown for forage in Maryland were severely attacked by adults of the Hispid, *Chalepus dorsalis*, Thnb., that had recently emerged from the foliage of black locust trees [*Robinia pseud-acacia*]. A heavy application of derris dust (0.75 per cent. rotenone) killed or drove away many of them and the plants rapidly recovered; the beetles showed no tendency to deposit eggs later on either treated or untreated plants. In view of this attack, however, soy beans cultivated for experimental purposes in Virginia and growing several hundred yards from the nearest black locust trees were examined early in August, and it was found that several varieties were infested, some plants bearing 10–12 mined leaves. A maximum of four mines was observed in one leaf, and not more than five larvae, two pupae or one adult occurred in a single mine. The eggs are laid on the lower surfaces of the leaves in masses of 3–5, and are covered with excrement. The newly-hatched larvae enter the leaf and feed between the upper and the lower epidermis [cf. *R.A.E.*, A **26** 549]. Some of the pupae from soy beans were parasitised by the Chalcid, *Spilochalcis albifrons*, Walsh, which has not previously been recorded from this host.

WILSON (C. C.). **Poisons in Baits for Grasshopper Control.**—*J. econ. Ent.* **33** no. 5 pp. 745–749, 12 refs. Menasha, Wis., 1940.

The following is taken from the author's summary. During the period 1924–36, liquid sodium arsenite, powdered sodium arsenite, Paris green and white arsenic (30–32, 85, 50 and 98.6 per cent. arsenic trioxide, respectively) were tested as poisons in bran baits for grasshoppers. The experiments were conducted principally in California, in localities ranging from 5,000 ft. above sea level to 121 ft. below sea level, and including meadowland, lucerne fields and practically barren desert.

The relative efficiency of the poisons was determined by comparing the mortalities in cages among grasshoppers collected from the poisoned plots. The grasshoppers included ten species in all stages of development, but most of them were older nymphs or adults.

Baits containing 1-5 U.S. pints liquid sodium arsenite, 1-4 lb. Paris green, 1-4 lb. white arsenic, and 2 or 4 lb. powdered sodium arsenite per 100 lb. bran were equally effective, but those containing  $\frac{1}{2}$  U.S. pint and 3 U.S. quarts liquid sodium arsenite were less so, the former being sublethal and the latter repellent.

The poisons and dosages recommended for use in grasshopper baits in California are 1 U.S. quart liquid sodium arsenite, 2 lb. Paris green, 2-3 lb. white arsenic or 2 lb. powdered sodium arsenite per 100 lb. bran.

PARMAN (D. C.). **The Development of Research in Preventive Entomology.**—*J. econ. Ent.* **33** no. 5 pp. 749-754, 2 figs. Menasha, Wis., 1940.

The author points out that preventing the development of destructive insect populations is preferable to controlling the insects when they have become injurious, and, with the object of stimulating further investigations, describes a logical procedure for research in preventive entomology, suitable for application to extensive areas. This consists in obtaining a census of the population of the insect in question, determining what climatic, host, disseminative, biological and other conditions might affect its establishment and multiplication and which of these have operated consistently, and investigating the affecting factors to find whether any of them can be easily controlled by man. The co-ordination and interpretation of the data are discussed and illustrated.

FLANDERS (S. E.). **Biological Control of the Long-tailed Mealybug, *Pseudococcus longispinus*.**—*J. econ. Ent.* **33** no. 5 pp. 754-759, 1 fig., 27 refs. Menasha, Wis., 1940.

Much of the information in this survey of data on the seven primary parasites that attack *Pseudococcus adonidum*, L. (*longispinus*, Targ.) refers to those that are now established in California, where the principal food-plants of the mealybug are *Citrus*, avocado and *Draacaena* [*R.A.E.*, A **29** 297]. Its distribution and economic importance elsewhere are briefly discussed; Australia, where its density is low and parasitism high, is considered to be its native habitat. Occasional and sporadic outbreaks that have occurred on grape-vine in Australia [*cf.* **17** 693] probably followed applications of sulphur, which is known to be inimical to parasitism by Hymenoptera. It is stated that in California the hyperparasite, *Thysanus* sp., and males of *Coccophagus gurneyi*, Comp., developed on *Tetracnemus peregrinus*, Comp., and that a female of *Achrysopophagus* sp. emerged from *P. adonidum* parasitised by *Anagyrus fusciventris*, Gir., of which *A. nigricornis*, Timb. [**7** 437] is a synonym.

*Leptomastix dactylopii*, How., appears to have become established in California from a single pair imported from Rio de Janeiro in 1934. It attacks mature mealybugs, but develops with difficulty in *P. adonidum* [*cf.* **27** 598]. The only other primary parasite not mentioned

in the author's previous paper [29 297] is *Acerophagus nubilipennis*, Doz., a single female of which was bred from *P. adonidum* in Porto Rico [cf. 14 387].

ELLISOR (L. O.) & BLAIR (C. R.). **Effect of Temperature upon the Toxicity of Stomach Poisons.**—*J. econ. Ent.* **33** no. 5 pp. 760-762, 3 refs. Menasha, Wis., 1940.

The following is substantially the authors' summary. A modification of previous single-leaf methods [*R.A.E.*, A **25** 245; **26** 388] of feeding the larvae to determine the median lethal dose is described. Determinations were made of the median lethal doses of synthetic cryolite (Alorco), acid lead arsenate, basic copper arsenate and calcium arsenate for fifth-instar larvae of *Anticarsia gemmatilis*, Hb., and *Laphygma (Prodenia) eridania*, Cram., at temperatures of 60° and 80°F. In all but one instance the insecticides were more toxic at 60°F., but the mean survival period was shorter at 80°F. All the insecticides tested were more toxic to *A. gemmatilis* than to *L. eridania*, except basic copper arsenate, which showed very little difference.

WHITEHEAD (F. E.) & FENTON (F. A.). **An Airplane Survey of Green Bug Injury in Oklahoma.**—*J. econ. Ent.* **33** no. 5 pp. 762-768, 9 figs. Menasha, Wis., 1940.

The authors describe a survey in which aeroplanes were used to ascertain the extent and severity of damage caused by *Toxoptera graminum*, Rond., to barley and wheat in Oklahoma. It was carried out in March and April 1939 as a result of an unusually severe and early outbreak of the Aphid [cf. *R.A.E.*, A **29** 251]. The appearance of the infestations from the air is described, with characteristics, such as the circular shape and typical colouring, that distinguish them from bare patches due to other causes. The survey was carried out at an elevation of 1,000-1,500 ft., at cruising speeds of 80 or 100 miles per hour, but doubtful records were checked by extremely low flights almost at landing speed (35 m.p.h. with additional reduction for wind). Fields with light, medium or heavy infestations were marked on a map, and the acreage infested was estimated. Comparison of the estimated and actual extent of the outbreak showed that the forecast was surprisingly accurate.

The advantages of an aerial survey over one made by car are the speed, the greater thoroughness possible, the ease of choosing efficient routes and cheapness. It is considered that a survey in February, when infestations are small, followed by control of the infestations by a ground crew, might be practicable, and that such eradication of initial infestations within the endemic area would delay the development of destructive populations and the northward migration of the Aphid until the grain is sufficiently mature to resist attack.

MORAN (E. J.) & LYLE (C.). **Observations on *Cirphis unipuncta* Haworth in Mississippi.**—*J. econ. Ent.* **33** no. 5 pp. 768-769, 3 refs. Menasha, Wis., 1940.

The first outbreak of *Cirphis unipuncta*, Haw., in Mississippi since records began in 1900 occurred in 1931 on oats in the Delta section, and in 1937 and 1938 the same crop was severely damaged in this area.

All stages of the Noctuid were observed throughout the winter of 1938-39; the moths were caught in light traps at State College whenever the weather was favourable and usually oviposited on oat plants out-of-doors within 2-3 days. Many oviposited on days when the minimum temperature was below freezing point, and one when it was as low as 24°F. The incubation period varied from 2 days in July, when the mean temperature was about 86°F., to 35 days in December and January, when the mean minimum temperature was 38° and the extreme 18°F. The larval stage averaged about three weeks in summer and lasted all the winter for larvae hatching during November-January, and the pupal period varied from 10 to 15 days in summer and from 32 to 57 days in midwinter for pupae kept in boxes in exposed situations. The pupal stage lasted all the winter when larvae that hatched in October pupated in the ground in a shaded position.

LINCOLN (C. G.) & PALM (C. E.). **Control of the Alfalfa Snout Beetle, *Brachyrhinus ligustici* (L.).—*J. econ. Ent.* 33 no. 5 pp. 769-773, 6 figs., 2 refs. Menasha, Wis., 1940.**

The following is based on the authors' summary. During 1935-38 experiments with poison baits were carried out on field plots in an attempt to devise a cheap and effective control for *Otiorrhynchus* (*Brachyrhinus*) *ligustici*, L., which infests clover and lucerne over an area of about 3,000 acres in New York. The standard bait of raisins, wheat shorts and sodium fluosilicate [*cf. R.A.E.*, A 19 528; 25 180] proved very effective. In 1938, several promising substitute baits were developed, the best of which has already been noticed [29 252]. Paris green and white arsenic were much less effective in the standard bait than sodium fluosilicate and sodium fluoride. Standard raisin bait that has been stored long enough to become mouldy is unattractive. The addition of 0.2 per cent. sodium benzoate effectively prevented moulding and did not render the bait repellent.

JOHNSON (P. C.). **Entomological Considerations in Utilization of Insect-killed Ponderosa Pine.—*J. econ. Ent.* 33 no. 5 pp. 773-776, 5 refs. Menasha, Wis., 1940.**

Experimental logging operations were conducted by two lumber companies in northern California during 1935 to salvage timber left in trees killed by bark beetles. Nearly 5,000,000 board feet of dead and dying ponderosa pine (*Pinus ponderosa*) were removed from the woods and utilized in neighbouring sawmills. Examination of the boles of felled infested trees showed a significant correlation between the blue staining and the insect species present and between the staining and brood development. The percentage of timber rejected owing to blue staining amounted to as much as 50 in trees containing advanced broods of Scolytids of the genera *Dendroctonus* and *Ips*, and the Buprestid, *Melanophila californica*, Van Dyke. Staining was much more rapid than average in trees attacked by *Ips emarginatus*, Lec., and much slower in those attacked by the Buprestid.

A decline of 40 per cent. in infestation occurred in the year following salvage, probably owing to the removal of a large proportion of the beetle populations and the arrested development and heavy mortality

from solar heat of the broods remaining in the unsalvaged sections of the trees. The reduction in loss was approximately the same as that following direct control (felling and barking infested trees and burning the bark) under similar conditions in the neighbourhood. Infestations in untreated areas remained unchanged or increased slightly during the same period. The losses two years after salvage appeared to approach the level of those in untreated areas, but it is believed that more favourable control would have resulted if the salvage programme had been confined to the months when control measures are more effective.

FRENCH (G. T.). **Standardization and Uniformity in Plant Pest Control.**—*J. econ. Ent.* **33** no. 5 pp. 776–779. Menasha, Wis., 1940.

NEWELL (W.). **Federal-State Relations.**—*T.c.* pp. 779–784.

HOYT (A. S.). **Federal-State Relations.**—*T.c.* pp. 784–787.

In the first of these papers, the author emphasises the desirability of a uniform system of inspection, treatment and quarantine throughout the United States, in order to prevent or control the introduction and dissemination of insect pests. The second paper deals with the relations between the States and the U.S. Bureau of Entomology and Plant Quarantine, with particular reference to the eradication of insect pests or their control on a large scale, and the third with the effect of the personal relations between Federal and State officials on the conduct of such projects.

YOUNG (M. T.), GARRISON (G. L.) & GAINES (R. C.). **Insecticides for Boll Weevil Control.**—*J. econ. Ent.* **33** no. 5 pp. 787–792. Menasha, Wis., 1940.

An account is given of experiments in Louisiana in 1939 with dusts for the control of the boll weevil [*Anthonomus grandis*, Boh.] on cotton. Plots dusted early in the morning with calcium arsenate containing 4.6 per cent. water-soluble arsenic pentoxide by the New York method showed a significant decrease in infestation over plots dusted at midday and late in the afternoon, but there were no significant differences among the yields, and all the plots showed highly significant decreases in infestation and significant increases in yield over the untreated plots. Calcium arsenate (3.5 per cent. water-soluble arsenic pentoxide) caused a highly significant decrease in infestation and increase in yield as compared with the control, but the figures for cryolite mixtures containing 33.8 and 89.3 per cent. sodium fluo-aluminate were not significant. The stronger cryolite dust caused severe scorching of the foliage, but the addition to it of 1 per cent. of Lethane spreader resulted in very light scorching and a significant increase in yield over this cryolite alone. Calcium arsenate alone and mixtures of calcium arsenate with sulphur (1 : 1 or 1 : 2) were about equal in effectiveness; sulphur alone was less effective. The addition of 5 per cent. of an adhesive did not improve the control given by calcium arsenate. Throughout the experiments, the average quantity of calcium arsenate applied at each dusting ranged from 5.6 to 6.4 lb. per acre, and the average quantity of cryolite, sulphur and mixtures of calcium arsenate and sulphur applied at each dusting was approximately 15 lb. per acre.

GAINES (R. C.), YOUNG (M. T.) & SMITH (G. L.). **Effect of Insecticides used in Boll Weevil Control upon Aphids and Mirids.**—*J. econ. Ent.* **33** no. 5 pp. 792–796, 2 refs. Menasha, Wis., 1940.

Tests were carried out in Louisiana in 1939 to determine the effect of dusts used against the boll weevil [*Anthonomus grandis*, Boh.] on cotton on infestation by *Aphis gossypii*, Glov., and Capsids, and the injury caused by the Aphid. Many more Aphids occurred on plots treated with calcium arsenate than on untreated plots; there was no significant difference between the numbers on plots treated with 4–6 lb. per acre of calcium arsenate or calcium arsenate and sulphur (1 : 1). Plots treated with calcium arsenate containing 10·3 per cent. water-soluble arsenic pentoxide by the New York method contained significantly larger numbers of Aphids than those treated with calcium arsenate containing 0·5 per cent., and produced 66 lb. less seed cotton per acre. The difference in yield may have been due partly to the Aphids, since laboratory tests [*R.A.E.*, A **27** 246] have shown that calcium arsenate is most effective against the weevil when it has a high percentage of water-soluble arsenic pentoxide [but cf. **28** 474]. Records from cage tests, in which the plants were dusted with a number of arsenates varying greatly in effectiveness against the weevil, showed that the number of Aphids varied directly with the efficiency of the poisons against *A. grandis* and inversely with the yield obtained. The variation in infestation by the weevil was so slight that its effect on the yields was unimportant. In a factorial experiment carried out to determine the effect of Aphid control, weevil control and a combination of both on the yield of seed cotton, a mixture of nicotine sulphate and lime containing about 3 per cent. nicotine was used against the Aphid and calcium arsenate (3·5 per cent. water-soluble arsenic pentoxide) against the weevil. The average increases for weevil control with and without Aphid control was highly significant (190 lb. per acre), whereas that for Aphid control with and without weevil control was not significant (90). Without Aphid control the increase for weevil control was not significant (140); with Aphid control it was significant (230). The increases for Aphid control with weevil control (130) and without (40) were not significant. The increase for combined control of both insects (270) was highly significant.

In a single series of tests, calcium arsenate (3·5 per cent. water-soluble arsenic pentoxide) controlled light infestations of the Capsids, *Lygus pratensis oblineatus*, Say, and *Adelphocoris rapidus*, Say, and did not differ significantly in effectiveness from sulphur alone and mixtures of calcium arsenate and sulphur (1 : 1 and 1 : 2).

GENTNER (L. G.). **Spur-burrowing Habit of Codling-moth Larvae on Pear Trees.**—*J. econ. Ent.* **33** no. 5 pp. 796–799, 5 figs. Menasha, Wis., 1940.

For several years past, larvae have been observed burrowing in the fruit spurs of pear trees in the Rogue River Valley in southern Oregon, both during the growing season and after the fruit has been harvested, and in 1937 they were identified as those of *Cydia* (*Carpocapsa*) *pomonella*, L. Since young larvae of both the first and second generations burrow into fruit spurs with fruit attached, it is possible that a spur-burrowing strain of the moth exists. There is enough

food in the spurs to permit the larvae to develop to the adult stage. Fruit spurs of Bosc and Anjou pear trees with larval injury can be found quite generally throughout the valley in well-sprayed orchards during the growing season, and this type of injury is increasing. An unsprayed Bosc tree examined three weeks after harvest had 251 spurs in which larvae had recently worked or were still at work. Black, mummified, young pears adhering to injured spurs in the first-brood period may be mistaken for those killed by fire blight. The larvae sometimes almost completely hollow out the spurs, cutting off the food supply to the fruit and leaves attached to the outer end of the spur; these may turn black and hang until after harvest, or may drop prematurely. The larvae usually enter through a scar left by the separation of a fruit stem from the spur, and no practical control can be recommended as the natural fruit drop extends over a long period of time, leaving points of entry without adequate spray protection.

YOTHERS (M. A.) & GRIFFIN (S. W.). **Tests of Rotenone, Anabesine, Nicotine, and other Insecticides against the Woolly Apple Aphid and the Apple Aphid.**—*J. econ. Ent.* **33** no. 5 pp. 800–803, 1 fig., 4 refs. Menasha, Wis., 1940.

Experiments in which sprays of rotenone and anabesine sulphate were compared with nicotine sulphate and a light-medium summer-oil emulsion against *Eriosoma lanigerum*, Hsm., and *Aphis pomi*, DeG., on twigs of apple were carried out in Washington during 1931–33. An activator consisting of a proprietary sulphonated petroleum oil was added to some of the sprays, and various wetting agents were used. Of the latter, a proprietary alkylated naphthalene sulphonate, pine-tar soap and sodium oleate were effective in sprays against *E. lanigerum* and also had a certain lethal value of their own.

The oil emulsion (0.83 per cent. actual oil) gave unsatisfactory control of both Aphids. Nicotine sulphate at concentrations of 1 : 3,200 and 1 : 4,800 gave 100 and 97.5 per cent. mortality of *E. lanigerum* when used with 2 and 4 lb. of the proprietary wetting agent per 100 U.S. gals., respectively, and 99.6 and 81.8 per cent. of *A. pomi* with 1 lb. sodium oleate. With the same wetters and at the same concentrations, anabesine sulphate gave 100 and 96.6 per cent. mortality of *E. lanigerum* and 99.1 and 95.1 of *A. pomi*. The mortality of the former given by anabesine sulphate was not improved by the substitution for the wetter of  $\frac{1}{2}$  lb. activator per 100 U.S. gals. Rotenone crystals dissolved in acetone and used at a concentration of 8 oz. per 100 U.S. gals. gave complete mortality of *A. pomi* with or without a wetter, but were not effective against *E. lanigerum*, the highest percentage mortality being 93.5, when 4 lb. soap was added. The activator gave better results at 1 than at 0.5 per cent., even though the rotenone concentrations were lower. With rotenone at 3 oz., the percentage mortality of *A. pomi* was still 100 and 99.9 when ethyl alcohol and 1 lb. sodium oleate were added, respectively, but that of *E. lanigerum* did not exceed 82.2 (with 4 lb. of the proprietary wetter) and was generally much lower. Tests with  $\frac{1}{2}$  U.S. gal. activator per 100 U.S. gal. water alone and with 8 oz. rotenone showed that there was a positive correlation between the temperature during the post-spray period and the percentage mortality of *E. lanigerum*.

CALLENBACH (J. A.). **Influence of Road Dust upon Codling Moth Control.**—*J. econ. Ent.* **33** no. 5 pp. 803–807, 1 fig., 4 refs. Menasha, Wis., 1940.

The main results of the investigations here described in detail on the detrimental effect of deposits of road dust on the control of the codling moth [*Cydia pomonella*, L.] on apple in Wisconsin by means of sprays have already been noticed [*R.A.E.*, A **27** 33; **28** 12].

SMITH (F. F.) & SULLIVAN (W. N.). **Effect of Pyrethrum and Derris on the Black Blister Beetle.**—*J. econ. Ent.* **33** no. 5 pp. 807–810, 2 refs. Menasha, Wis., 1940.

The following is based largely on the authors' introduction and summary. During 1937, *Epicauta pennsylvanica*, DeG., invaded an experimental field of china asters in Maryland in such numbers that control measures were necessary. Since the beetles devoured the inner flower parts as soon as the buds showed colour, a rapid kill was essential and contact sprays were used. Sprays containing pyrethrum extracts (pyrethrins 1 : 10,000 and 1 : 22,000) gave complete mortality of *Diabrotica duodecimpunctata*, F., *D. melanocephala*, F. (*vittata*, F.), *Lygus pratensis oblineatus*, Say, and *Halticus citri*, Ashm., which occurred on the plants at the same time, but killed only 68·8 and 42·6 per cent., respectively, of *E. pennsylvanica*. When the pyrethrum content was increased to 1 : 5,000, the percentage mortality of *E. pennsylvanica* was 73·5, and this figure rose to 84·9 and 91·6 when rotenone at concentrations of 1 : 18,000 and 1 : 4,000 was added, in the form of derris extract and derris powder, respectively. The derris powder killed 11·1 per cent. when used alone. A commercial spreader containing alkylphenylbenzenesulphonic acid was added at the rate of 2 gm. per U.S. gal. to all sprays except that containing the lowest concentration of pyrethrins.

Since repeated treatment was necessary to protect asters from a rapidly changing population of beetles, the effect of a second application on insects surviving the first was tested in the laboratory on beetles collected in the field. Alcoholic pyrethrum extract diluted to give pyrethrin contents of 1 : 8,000 and 1 : 16,000 in water was used with sodium lauryl sulphate (1 : 3,000) as a spreader. The more concentrated spray killed 77 per cent. of the beetles on the first application and only 44 per cent. of the survivors on the second, while the corresponding percentages for the other spray were 57 and 28. It is concluded that the first application killed the weaker beetles and had a residual effect on the survivors, since some of them succumbed to the second treatment. No differences between the sexes in susceptibility or resistance occurred.

HOFFMAN (W. A.). ***Eufallia unicastata*, a Fungus eating Beetle new to Puerto Rico.**—*J. econ. Ent.* **33** no. 5 pp. 810–811. Menasha, Wis., 1940.

Late in 1939 and during the early months of 1940, adults of the Lathridiid, *Eufallia unicastata*, Belon, were found in Porto Rico on the walls of rooms painted with casein wash paint. They became numerous only during damp weather. Breeding experiments showed that the larvae and adults did not feed on particles of casein, but on fungi growing on the paint.

NEWCOMER (E. J.). **Natural Dispersion of *Aphelinus mali* (Hald.).**—*J. econ. Ent.* **33** no. 5 p. 811, 4 refs. Menasha, Wis., 1940.

Three cases are recorded from the north-western United States showing that *Aphelinus mali*, Hald., which was introduced for the control of *Eriosoma lanigerum*, Hsm., on apple, is able to spread considerable distances over country in which there are no apple trees and in which the Aphid is not present. In the first case it had travelled 8-9 miles over open country in which there was only a single orchard; in the second it appeared on an isolated apple tree infested by the Aphid and situated at least ten miles from any orchard; and in the third it was found in a heavily infested orchard 25-30 miles from the orchard in which it had been liberated four years previously, the intervening area being flat farming country with occasional apple trees or small orchards.

RITCHER (P. O.). **Poison Bait for Control of the Strawberry Crown Borer.**—*J. econ. Ent.* **33** no. 5 p. 812, 2 refs. Menasha, Wis., 1940.

A study of poison baits for the control of *Tyloderma fragariae*, Riley, on strawberry was begun in Kentucky in March 1940. The bait was applied round the crowns of the plants. In laboratory tests, overwintering adults were attracted to baits with a fruit base, but hardly at all to those with a bran base, and sodium fluosilicate and lead arsenate were both effective poisons. Field tests carried out during June-August showed that a bait consisting of 96.5 per cent. dried chopped apple refuse coated with 3.5 per cent. sodium fluosilicate gave 87.5-100 per cent. mortality in plots surrounded by barriers with the metal lip on the inside [*cf. R.A.E.*, A **26** 737] and 77.7-84.3 per cent. in open plots, where migration was possible and adults were emerging.

REED (W. D.) & HARRISON (P. K.). **Fumigation Tests in open Tobacco Warehouses.**—*J. econ. Ent.* **33** no. 5 pp. 812-813, 1 fig. Menasha, Wis., 1940.

In September and October 1939, tests were made in Virginia to determine the possibility of using hydrocyanic acid gas to fumigate tobacco in warehouses of the open type for the control of *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F. Doors and louvers were sealed with waterproof paper or canvas and spaces round rivets and other openings with a plastic insulating material. The fumigant was used at rates of 8 and 6 oz. per 1,000 cu. ft. with an exposure of 24 hours at temperatures of 82° and 70-71°F., respectively, and the results were calculated from the mortality of eggs, larvae and adults of both insects exposed in the space unoccupied by tobacco. Both dosages gave 100 per cent. mortality of all these stages of *E. elutella* and of the eggs of *L. serricorne*, but only the higher dosage killed all the larvae and adults of the latter. It is considered that dosages of 10 and 12 oz. per 1,000 cu. ft. should be tested.

FLANDERS (S. E.). **Searching for Entomophagous Insects.**—*J. econ. Ent.* **33** no. 5 p. 814, 8 refs. Menasha, Wis., 1940.

The author discusses the advisability of searching in artificial rather than natural environments for parasites to be used in biological

control. He points out that if a parasite is to be introduced into unnatural associations of plants or animals, it should be sought first in similar environments in the country of origin, since a species that is effective under such conditions is most likely to be successfully established in a new habitat, and the discovery of both host and parasite is facilitated by artificial environments, in which insects occur at higher densities and in greater numbers than under natural conditions. He cites instances of the discovery of important parasites of Coccids when the latter were infesting plants in cities in various countries.

GOULD (E.) & GEISSLER (G. H.). **Parasites of the Pistol Case-bearer.**—*J. econ. Ent.* **33** no. 5 pp. 814–815, 2 refs. Menasha, Wis., 1940.

Control of *Coleophora malivorella*, Riley, which has gradually increased in importance as a pest of apple in West Virginia since 1927, by means of insecticides has not proved entirely satisfactory [*cf. R.A.E.*, A **24** 726], but this Tineid is attacked by large numbers of parasites that normally give adequate control. A single generation is exposed to parasitism for more than eleven months [*cf.* **18** 404; **28** 219]; the larvae are accessible at all stages, and the cases afford protection to overwintering parasites. A list is given of forty species of parasites bred from *C. malivorella* in West Virginia, with five additional species bred in Virginia; three of them are egg-parasites.

JEWETT (H. H.). **Observations on Life History of *Aeolus mellillus*.**—*J. econ. Ent.* **33** no. 5 p. 816, 8 refs. Menasha, Wis., 1940.

*Drasterius (Aeolus) mellillus*, Say, has for many years been a pest of tobacco in Kentucky [*cf. R.A.E.*, A **28** 367], where its life-cycle is completed in one year. This Elaterid is presumably parthenogenetic in Canada [*cf.* **24** 605], and in central Kentucky males have not been taken in the field or bred from larvae collected at different times of the year. Several attempts to induce females to oviposit were unsuccessful, but five bred from larvae collected in April 1940 laid 91 eggs between 29th May and 14th June, and 45 of these eggs hatched between 12th and 17th June after incubation periods of 9–15 days.

COLMAN (W.). **Effect of Paradichlorobenzene on the Feeding of the Black Carpet Beetle.**—*J. econ. Ent.* **33** no. 5 pp. 816–817, 3 refs. Menasha, Wis., 1940.

In view of the fact that paradichlorobenzene is often used against clothes moths and carpet beetles under adverse conditions, where it is difficult to obtain a high concentration of the vapour, and may still protect fabrics from damage, tests were conducted to demonstrate the effect of low concentrations of paradichlorobenzene on the feeding of larvae of *Attagenus piceus*, Ol. Approximately half-grown larvae were placed on cloth and fumigated in closets under conditions similar to those in clothes cupboards. The paradichlorobenzene and cloth were weighed at weekly intervals to determine the amount of fumigant that had evaporated and the amount of food that was consumed. The larvae in two closets were thus exposed to low and gradually diminishing concentrations of the vapour for 5 and 7 weeks. Their feeding was greatly reduced in the first week and ceased during the remainder of the period in each closet, but after this large proportions of them were still alive and resumed normal feeding.

CHAPMAN (P. J.). **Effect of Methyl Bromide on Apple Maggots in Apples.**—*J. econ. Ent.* **33** no. 5 p. 817, 2 refs. Menasha, Wis., 1940.

The results are given of preliminary studies carried out in New Jersey in August 1939 to determine the effect of fumigation with methyl bromide on the larvae of *Rhagoletis pomonella*, Walsh, in apples [*cf. R.A.E.*, A **27** 541]. Picked apples, containing first- and second-instar larvae and possibly eggs, and windfall fruit, containing chiefly second- and third-instar larvae, were fumigated with 1, 2 and 4 lb. methyl bromide per 1,000 cu. ft. at atmospheric pressure, temperatures of 90–95°F. and relative humidities of 58–75 per cent. The periods of exposure were 1, 2 and 4 hours for each rate of application. An average of 2.79 and 3 larvae per fruit emerged over a period of 50 days from untreated picked apples and windfalls, respectively. Exposure to 1 lb. fumigant for one hour gave about 91–92 per cent. control, and all the other treatments gave complete kills. Definite injury was observed in fruit treated with 2 lb. fumigant for four hours and in all fruit treated with 4 lb., with the exception of picked fruit exposed for only one hour.

FLEMING (W. E.) & BURGESS (E. D.). **Attractiveness to the Japanese Beetle of Mixtures of commercial Geraniol and Eugenol.**—*J. econ. Ent.* **33** no. 5 p. 818, 5 refs. Menasha, Wis., 1940.

The results are given of experiments carried out in 1939 to compare the attractiveness to *Popillia japonica*, Newm., of commercial geraniol, U.S.P. eugenol and various mixtures of the two with that of the standard bait of geraniol and eugenol (10 : 1) [*cf. R.A.E.*, A **24** 303]. The test baits were not changed during the six weeks for which the traps were exposed in the field, but the standard bait was renewed weekly. When first placed in the field, geraniol, eugenol and the standard mixture were of the same order of attractiveness to the beetles. Mixtures of 10 parts geraniol with 2, 4 and 8 parts eugenol were definitely more attractive. After the first week the attractiveness of geraniol decreased, but that of eugenol and the mixtures did not change significantly during the season [*cf. 28* 573]. It also appeared that the attractiveness of the mixtures increased with the amount of eugenol in them.

HOFFMANN (C. H.) & MOSES (C. S.). **Mating Habits of *Scolytus multistriatus* and the Dissemination of *Ceratostomella ulmi*.**—*J. econ. Ent.* **33** no. 5 pp. 818–819, 2 refs. Menasha, Wis., 1940.

The authors describe an experiment carried out to determine whether one male of *Scolytus multistriatus*, Marsh., fertilises more than one female and whether, in so doing, it may transmit *Ophiostoma* (*Ceratostomella*) *ulmi*, the fungus that causes Dutch elm disease, to more than one brood burrow. A piece of elm branch was placed in each of 41 jars with six females bred from uninfected elm and one male that had been contaminated with the fungus. Examination 2–3 weeks later showed that the sections contained an average of seven burrows each, of which about five contained larvae. When the brood burrows were cultured, the fungus was recovered from 79 per cent. of those with larvae and 25 per cent. of those without larvae. It appears,

therefore, that a single contaminated male may distribute the fungus to several brood burrows while entering to pair with the females. It is possible, however, that some of the females and perhaps even mites may have become contaminated with the fungus and aided in disseminating it.

VINZANT (J. P.) & REED (W. D.). **Effect of insecticidal Residues in cured Tobacco on Tobacco Moth Larvae.**—*J. econ. Ent.* **33** no. 5 p. 819. Menasha, Wis., 1940.

During an outbreak of *Ephestia elutella*, Hb., on stored tobacco leaves in warehouses in certain parts of North Carolina and Virginia in the late summer and autumn of 1938, it was reported from North Carolina that little or no infestation developed on tobacco that had received a late application of lead arsenate for the control of hornworms [*Protoparce*] in the field. Leaves from tobacco that had been sprayed with 50 U.S. gals. per acre of a suspension of 4 lb. lead arsenate in 50 U.S. gals. water shortly before harvest were found to contain 448 parts arsenic trioxide per million. Larvae of *Ephestia* that hatched from eggs placed on these leaves all died, practically without feeding, whereas many larvae from eggs on unsprayed leaves fed and completed their development.

BUCHANAN (W. D.). **Ambrosia Beetle, *Xylosandrus germanus*, transmits Dutch Elm Disease under controlled Conditions.**—*J. econ. Ent.* **33** no. 5 pp. 819–820. Menasha, Wis., 1940.

In view of the fact that *Ophiostoma (Ceratostomella) ulmi*, the fungus causing Dutch elm disease, was isolated from two of 826 adults of *Xyleborus (Xylosandrus) germanus*, Bldf., collected from the surface of elm trap trees in New Jersey in 1936 [*cf. R.A.E.*, A **26** 325], experiments were conducted to determine whether it might be transmitted by this Scolytid to uninfected elm logs or even living trees. The beetles were allowed to bore into discoloured sections from a diseased elm tree and then into sections from an uninfected tree, and chips from the latter, containing one entrance hole each, were cultured for the presence of *O. ulmi*. The fungus was isolated from 16 of 94 of the chips and from 3 of 31 beetles taken directly from the diseased sections. In a second experiment, about 250 contaminated beetles were liberated on each of six healthy elm trees, in the trunks of which they made an average of 11.3 holes per tree. *O. ulmi* was subsequently isolated from five of the six trees, but only one developed typical external symptoms of the disease. In the others, the fungus was present only in the tissue adjacent to the holes made by the infected beetles.

SWAIN (R. B.). **A Field Method for estimating Mormon Cricket Injury to Forage.**—*J. Kans. ent. Soc.* **13** no. 4 pp. 124–127, 2 refs. Manhattan, Kans., 1940.

In recent years, *Anabrus simplex*, Hald., has been so abundant in many localities in the north-western United States that concern has been aroused as to its effect on range forage plants. Suggestions are therefore made for estimating the losses caused, based on the methods applied for the determination of the degree of utilisation of the pastures by livestock.

The forage values of a pasture for given kinds of livestock depend on the "proper-use factor" and on the percentage of each plant species in the pasture. The proper-use factor of a plant species is the percentage of the total current year's growth available to the livestock that is utilised when the ranges are properly grazed. These factors have been determined and tabulated by the Division of Range Research of the United States Forest Service. To compute the total forage value of a pasture, a survey is made of the percentage composition of its main forage plant species; the percentage of each species is then multiplied by its proper-use factor, and all the products are added. By the author's method, the average percentage loss caused to each plant species by *Anabrus* is estimated by numerous comparisons of injured and uninjured plants of the same stage of development and of about the same size, as well as by weighing equal numbers of injured and uninjured plants. The average percentage loss for each plant species is then multiplied by the respective percentage of the plant species in the pasture; the sum of these products represents the total amount of forage eaten by crickets. By subtracting this sum from the total forage value of the pasture, a figure is obtained showing the reduction in the latter; it can then be expressed as a percentage of the total value.

Estimates made by this method do not represent a complete picture of the destruction of the total herbage in a given pasture for two reasons. Firstly, damage to non-forage species, which may constitute a large proportion of the vegetation, is not shown; secondly, the damage exceeding the proper-use factor for livestock is not reflected in the percentage of the forage destruction.

PAINTER (R. H.), JONES (E. T.), JOHNSTON (C. O.) & PARKER (J. H.).  
**Transference of Hessian Fly Resistance and other Characteristics of Marquillo Spring Wheat to Winter Wheat.**—*Tech. Bull. Kans. agric. Exp. Sta.* no. 49, 55 pp., 18 figs., 22 refs. Manhattan, Kans., 1940.

The following is substantially the authors' summary. Marquillo spring wheat, which resulted from an interspecific cross made at the Minnesota Agricultural Experiment Station, has been found to possess marked resistance to the Hessian fly, *Mayetiola (Phytophaga) destructor*, Say, in both hard and soft wheat belts in the United States [cf. *R.A.E.*, A 20 43]. This fly resistance, which was incidentally carried over from the Tumillo durum wheat parent along with the stem-rust resistance for which the cross was made, has now been transferred to winter wheats by means of crossing. The fly resistance derived from Marquillo tends to be recessive, although it appears to be due to more than a single genetic factor. In these hybrids there was no evidence of linkage between fly resistance and resistance to disease, winter hardiness, spring or winter habit of growth, or other visible agronomic characters. The hybrids also represent a marked advance over their parents in ability to survive and produce grain under extremely heavy fly infestations. This tolerance is often less evident than the type of resistance resulting from low larval survival, but is of considerable importance, especially in combination with low larval survival. The different hybrid lines showed wide differences in the amount of damage done by wheat jointworm (*Harmolita tritici*, Fitch). Although all lines were sometimes heavily infested, some

had badly twisted and broken straws at the point of infestation, while other lines gave no such evidence of the presence of the insect, thus possessing a type of tolerance. The various winter type Marquillo hybrids have given several different combinations of resistance to fly, tolerance to jointworm and resistance to leaf rust, stem rust, bunt and mildew. Preliminary data indicate that the yield of Marquillo hybrids, particularly various lines of Marquillo  $\times$  Oro and Marquillo  $\times$  Tenmarq, may equal or excel that of standard varieties of winter wheats, such as Turkey and Tenmarq. Several possible explanations are given for the small infestation present on Marquillo and its hybrids. The total difference in fly resistance between them and susceptible varieties of winter wheat appears to be the result of the interaction between three or more separate heritable mechanisms—low larval survival, ability to withstand infestation, and under some conditions low oviposition. The most important result of this co-operative study has been the gathering together of resistance to Hessian fly and tolerance to wheat jointworm with resistance to leaf rust, stem rust, bunt and mildew in each of several strains of promising hard red winter wheat. This combination of insect and disease resistance is not found in any other winter wheat so far reported, and the Marquillo hybrids are the first winter wheats to show marked resistance to the Hessian fly in experimental tests in both hard and soft wheat belts wherever so far tested.

PAINTER (R. H.) & BRUNSON (A. M.). **Differential Injury within Varieties, Inbred Lines and Hybrids of Field Corn caused by the Corn Earworm, *Heliothis armigera* (Hbn.).**—*J. agric. Res.* **61** no. 2 pp. 81–100, 3 figs., 20 refs. Washington, D.C., 1940.

The following is substantially the authors' summary. A consistent tendency toward resistance or susceptibility to damage to the ears by *Heliothis armigera*, Hb., has been transmitted by certain inbred lines of maize. Length of husk extension and date of flowering have some influence on the amount of damage to ears, particularly in heterogeneous material, but many marked breaks in the correlations occur, suggesting other and more subtle causes of differences in severity of injury. Under conditions at Manhattan, Kansas, the relatively susceptible strains appear more sensitive to the influence of date of flowering and length of husk extension than do the relatively resistant strains. The greater influence of these factors in open-pollinated varieties may be due to the high proportion of susceptible individuals present in the material studied. Differences in resistance and susceptibility to injury to the developing curl or bud of young maize plants are also inherited. Such differences appear to be independent of the differences in resistance to damage to ears caused by the same insect. There are indications that resistance to injury by *H. armigera* may be increased by mass selection within an open-pollinated variety.

PHILLIPS (W. J.) & BARBER (G. W.). **Seasonal Abundance of Eggs of the Corn Ear Worm Moth in Virginia.**—*J. N. Y. ent. Soc.* **48** no. 4 pp. 305–317, 2 figs. New York, N.Y., 1940.

The following is taken from the authors' summary. On account of the habits of *Heliothis armigera*, Hb. (*obsoleta*, F.), it is not easy to determine its seasonal occurrence or abundance by means of counts

of the pupae, moths or larvae. It was thought that this information could be obtained by counts of eggs deposited on maize, as the numbers of eggs might reflect moth abundance and later larval populations indirectly. Daily examination in six years of selected maize plants of successive plantings in two localities and four environments in Virginia gave data on sixteen seasonal records of egg occurrence. Much difference was found in the seasonal occurrence of eggs, depending partly on the earliness or lateness of the spring or autumn.

In each seasonal occurrence studied, there were several days in the last week of July or the first week of August when eggs were extremely scarce or absent. This time of egg scarcity was used to divide each season into two periods, the first comprising, roughly, May, June and July, and the second August, September and October. Abundance of eggs varied greatly in different years; the number of eggs per plant per day ranged from 0.01 to 2.04 in the first period and from 0.06 to 7.89 in the second. Although eggs of the second period were usually more plentiful than those of the first, in 3 of 16 instances they were less abundant, and in one case the numbers were equal. Numbers of eggs of the second period ranged from 0.13 to 92 times those of the first period. Precipitation seemed to be a principal factor in determining the abundance of the eggs. During seasons of much rain the population of *H. armigera* increased little, but during seasons of little rain it increased greatly.

REX (E. G.). **A promising fungous Pathogen of adult Japanese Beetles** (*Popillia japonica*).—*J. N. Y. ent. Soc.* **48** no. 4 pp. 401–403. New York, N.Y., 1940.

In view of the desirability of discovering a readily communicable disease organism that would afford some control of adults of *Popillia japonica*, Newm., in New Jersey, a culture of the strain of *Beauveria bassiana* that was isolated from larvae of *Leptinotarsa decemlineata*, Say, in Canada [cf. *R.A.E.*, A **28** 23] was obtained for experimental purposes in November 1939. It was concluded from tests in which spores of the fungus were applied dry or as an aqueous suspension to third-instar larvae of *P. japonica*, or the larvae were confined in tins containing soil heavily infected with the spores, that the fungus showed little promise for utilisation against the larvae.

When adults were dusted with the spores, however, the percentage of infection was very high and often 100. About 75 per cent. of adults allowed to feed on leaves that had been sprayed with a dilute aqueous suspension of the spores became infected, as also did 20–70 per cent. of initially healthy adults kept in close association with others previously exposed to infection. When food-plants of the adults in the field were sprayed with an aqueous suspension of the spores, the rate of infection was not determined, but a number of dead, typically attacked beetles were found later under the treated plants. Some adults taken from the sprayed plants after having fed were subsequently killed by the fungus. Healthy adults that were dusted with the spores and then placed in outside screened cages began to die in four days, and practically all died within ten days. Healthy beetles were then introduced into these cages, and later large numbers of these died, exhibiting the typical external growth of *Beauveria*. It is concluded that the fungus shows considerable promise as an agent of natural control of the adults of *P. japonica*.

DUTKY (S. R.). **Two new Spore-forming Bacteria causing Milky Diseases of Japanese Beetle Larvae.**—*J. agric. Res.* **61** no. 1 pp. 57–68, 6 figs., 5 refs. Washington, D.C., 1940.

The spore-forming bacteria responsible for the A and B types of milky disease of the larvae of *Popillia japonica*, Newm., in the United States [cf. *R.A.E.*, A **29** 124, 125, etc.] are described as *Bacillus popilliae*, sp. n., and *B. lentimorbus*, sp. n., respectively, and the resistance of the spores to heat and the effect of temperature on the development of the disease in the larvae are discussed. The development of *B. popilliae* in the larvae apparently takes place at temperatures of 16–36°C. [60·8–96·8°F.] [cf. **29** 124, etc.], and the period necessary for the development of visible symptoms varied from 4 days at 34°C. [93·2°F.] to 14 days at 17°C. [62·6°F.]. Visible symptoms of type B disease developed in 9 days at temperatures of 30 and 25°C. [86 and 77°F.], but were less extensive at the higher temperature, and in 19 days at 15·5°C. [59·9°F.]. The maximum and minimum temperatures for development appeared to be in the region of 30 and 16°C. The spores occur mainly in the blood of the larvae, reaching numbers as high as 20,000 million of *B. popilliae* or 10,000 million of *B. lentimorbus* in a single insect.

GLASER (R. W.), MCCOY (E. E.) & GIRTH (H. B.). **The Biology and economic Importance of a Nematode parasitic in Insects.**—*J. Parasit.* **26** no. 6 pp. 479–495, 8 figs., 10 refs. Lancaster, Pa., 1940.

An account is given of eight years' work on the biology of *Neoaplectana glaseri*, Steiner, a Nematode parasitic in *Popillia japonica*, Newm., and other insects in New Jersey, carried out since the publication of a previous paper [*R.A.E.*, A **20** 471]. The various breeding media and the technique used in the laboratory are described. The Nematode passes through five stages in its life-cycle, but the third of these may or may not appear, according to conditions. If the second-stage larva is in an environment favourable for further development, the third stage is omitted and it proceeds directly to the fourth or pre-adult stage. This occurs in both insect hosts and cultures. If the second-stage larva is in an unsuitable environment, it ceases to grow, empties the alimentary tract and forms a new cuticle within the existing one. The second-stage cuticle forms a loose coat about the enclosed third-stage larva, which is then referred to as "ensheathed." The sheath is usually lost soon after the larva assumes a free-living existence in the soil, and the larva is then called "exsheathed." This free-living stage has proved to be the infective one, irrespective of the presence or absence of the sheath, and corresponds to the "Dauerlarve" of Bøvien [**26** 49]. The "exsheathed" larva develops to the pre-adult form, which in turn develops to the adult male or female. Males are easily distinguished by their smaller size, greater activity, and characteristically curved posterior end, while the females vary greatly in size [cf. **27** 165]. Pairing occurs soon after maturity. The majority, and sometimes all, of the offspring are born while the female is still alive, but if it dies before all the larvae are born, some remain in the uterus for several days and may reach the second larval stage before escaping. Development is rapid and under optimum conditions is completed in 5–7 days, depending on the occurrence or suppression of the third stage.

The free-living infective Nematodes survive for at least  $1\frac{1}{2}$  years in the absence of host insects. During the warmer periods of the year, they parasitise the host insects present in the soil, but parasitism is very limited at a soil temperature of  $10^{\circ}\text{C}$ . [ $50^{\circ}\text{F}$ .] and does not become significant until the temperature reaches  $18^{\circ}\text{C}$ . [ $64.4^{\circ}\text{F}$ .]. The Nematodes develop rapidly within the host, and second-stage larvae of the new generation may appear within 5 days of invasion. The hosts mostly die by this time, but development continues in the dead host, in which two successive generations are sometimes produced. Finally, all that remains of the host larva is a skin and head capsule, filled with a thin fluid swarming with larval Nematodes. These then ensheath, and the integument of the host breaks so that they are liberated in the soil. As many as 2,400 infective-stage larvae have been recovered from one larva of *Popillia japonica*, but the average number probably does not exceed 1,500.

*N. glaseri* also parasitises adults of *P. japonica* when these occur in the soil and is disseminated by them. It has recently been found to attack larvae of *Anomala orientalis*, Waterh., as readily as those of *Popillia*, and can also infest and develop in larvae of other Lamellicorns, *Pantomorus leucoloma*, Boh., and, if they are placed in infested soil, even *Pyrausta nubilalis*, Hb. Moreover, it has been observed apparently thriving in dead Elaterid pupae and Noctuid larvae recovered from field plots.

The natural distribution of the Nematode in New Jersey is very limited, but experiments have shown that it is easily established in uninfested areas. Better results have been obtained by infesting field plots with ensheathed worms rather than those direct from culture, and by distributing them continuously over the surface of the soil as a water suspension, followed by sprinkling with water, than by introducing them beneath the turf at certain spots. In one series of plots, established in 1931, in which larvae of *P. japonica* have been added to the soil each spring and autumn, the Nematode has survived for  $8\frac{1}{2}$  years, while in another, in which work was begun in 1933 [24 9] and in which the host population has not exceeded 5.4 larvae per sq. ft. since 1934, it has maintained itself for  $6\frac{1}{2}$  years. The percentage parasitism has ranged in all from 0.3 to 81, depending on conditions.

GIRTH (H. B.), MCCOY (E. E.) & GLASER (R. W.). **Field Experiments with a Nematode Parasite of the Japanese Beetle.**—*Circ. N. J. Dep. Agric.* no. 317, 21 pp., 3 figs., 7 refs. Trenton, N.J., 1940.

A detailed account is given of experiments carried out since 1931 in New Jersey on the control of larvae of *Popillia japonica*, Newm., in the soil by means of *Neoaplectana glaseri*, Steiner [cf. preceding abstract]. The optimum conditions for parasitism are a soil temperature of at least  $60^{\circ}\text{F}$ . at a depth of 1.5 ins., a soil moisture of 20 per cent. or higher, with the soil not flooded, a heavy host population, and turf or other permanent cover. An attempt is now being made to distribute the Nematode throughout New Jersey, and colonies are being established at intervals of  $3\frac{1}{2}$  miles over the State.

BUCHANAN (L. L.). **Three new Species of the longulus Group of *Cylindrocopturus* (Coleoptera : Curculionidae).**—*Proc. ent. Soc. Wash.* 42 no. 8 pp. 177–181. Washington, D.C., 1940.

Descriptions are given of the adults of both sexes of *Cylindrocopturus furnissi*, sp. n., reared from twigs of *Pseudotsuga taxifolia*

in Washington, Oregon and California; *C. deleoni*, sp. n., reared from roots and root collars of *Pinus contorta* in Wyoming, and taken on *P. ponderosa* in Idaho and *P. contorta* var. *latifolia* (*murrayana*) in Montana; and *C. eatoni*, sp. n., reared from twigs of *P. ponderosa* and jeffrey pine [*P. jeffreyi*] in California.

FREAR (D. E. H.) & WORTHLEY (H. N.). **Deposition and Retention of Sprays on Apples.** II.—*Bull. Pa agric. Exp. Sta.* no. 400, 22 pp., 5 graphs, 12 refs. State College, Pa., 1940.

The following is taken from the authors' summary. The results are recorded of chemical analyses made to determine the amounts of lead and arsenic deposited and retained on apples sprayed in Pennsylvania with acid lead arsenate (at the rate of 3 lb. per 100 U.S. gals. water unless otherwise stated) in various schedules and mixtures during 1937 and 1938 [*cf. R.A.E.*, A 27 52]. The varieties used were Jonathan in both years and Stayman Winesap in 1938.

Deposits of lead and arsenic were greater on fruits from the bottoms of the trees than on those from the tops. Calculations of the ratio of lead to arsenic trioxide in the data collected gave no consistent figure for either fresh or weathered deposits, nor consistent differences in the ratios exhibited in different spray mixtures. The ratio in treatments to the Jonathan variety was 3.52 in 1937 and 2.15 in 1938. In treatments applied to Stayman Winesaps and to Jonathans from the same tanks of spray mixture in 1938 the ratio was nearly twice as great in the former (4.16 and 2.15). In 1937, the spacing of applications at progressively longer intervals to compensate for the diminishing growth rate of the fruits did not maintain a consistently higher level of spray deposits than the spacing of applications at uniform intervals, when both schedules consisted of five cover sprays ending on the same date. It appeared in 1937 that the addition of 1 U.S. pint fish oil per 100 U.S. gals. spray mixture resulted in greater deposits of lead and arsenic than the addition of 1 lb. soy-bean flour. Retention of lead, but not of arsenic, was greater with soy-bean flour. As compared in schedules of four cover sprays in 1938, soy-bean flour at 1 lb. and skim-milk powder at  $\frac{1}{2}$  lb. per 100 U.S. gals. spray mixture showed little difference in their effect on the deposit and retention of lead and arsenic. In 1937, a schedule of three cover sprays ending on 26th June, the last two of which were an inverted (or W.S.C. Dynamite) spray mixture [*cf. 25 652*], built up considerably higher deposits of lead and arsenic than any non-inverted sprays. After 32 days' exposure, however, the deposits were lower than in treatments receiving two additional non-inverted spray applications ending on 17th July, and thus analysed after 11 days' exposure. In 1938, a treatment involving two cover sprays, the second of which was a modified W.S.C. Dynamite spray [*cf. 25 653*] comprising a double concentration of lead arsenate (6 lb. per 100 U.S. gals.) and applied at a double dosage per tree on 6th June, showed deposits of lead and arsenic nearly as great as those in treatments receiving the last of four lead arsenate sprays in non-inverted mixtures on 30th June, when fruit samples were analysed on 1st July. The inverted spray afforded as good a control of the codling moth [*Cydia pomonella*, L.] as more extended spraying schedules.

HAEUSSLER (G. J.). **Parasites of the Oriental Fruit Moth in Japan and Chosen and their Introduction into the United States.**—*Tech. Bull. U.S. Dep. Agric.* no. 728, 62 pp., 3 figs., 15 refs. Washington, D.C., 1940.

The following is based on the author's summary. In a survey made during 1932 and 1933 in many of the important peach-, pear- and quince-producing regions of Japan and Korea, 61 species of parasites were reared from *Cydia* (*Grapholitha*) *molesta*, Busck.

*Trichogramma minutum*, Riley, which was found in Korea and Honshu, was the only egg parasite reared, although the Braconid, *Phanerotoma grapholithae*, Mues., which is a primary parasite of twig-infesting larvae, also oviposits in the egg of the host. Eggs of *C. molesta* were parasitised at 18 of 21 localities surveyed for egg parasites, *Trichogramma* being reared from 69.5 per cent. of 59 lots of eggs exposed.

The 22 species that parasitised twig-infesting larvae comprised 11 Braconids, 8 Ichneumonids and 3 Tachinids. Of these, *Angitia* (*Inareolata*) *molestae*, Uch., was the dominant parasite in ten Prefectures, *Apanteles taragamae*, Vier., in seven, *A. molestae*, Mues., in three, *Elodia flavipalpis*, Aldr., and *Macrocentrus thoracicus*, Nees, each in two, and *Phanerotoma grapholithae* and *Eubadizon extensor*, L., each in one. The first six of these occurred in both Japan and Korea, but *E. extensor* was obtained only in Japan. Of the 38 species of Hymenoptera, belonging to 10 families, that were reared as parasites of stages within the cocoon, 19 emerged only as primary parasites; 3 were reared to the adult stage as primary parasites only, although in laboratory tests they attacked and destroyed certain primary parasites without maturing; 2 were reared only as secondary parasites; 11 occurred both as primary and secondary parasites; and the host relationship for 3 could not be determined.

The percentage of twig-infesting larvae parasitised, as estimated from comparable records obtained during June in 1932 and 1933, averaged more than 50 in all collections made from Korea, where it was considerably higher than on any one of the three islands surveyed in Japan. In Japan it was highest in Kyushu, somewhat lower in Shikoku, and comparatively very low in Honshu, where it remained low throughout the entire season of 1932.

Approximately one cocoon of every five that were collected or exposed in numerous localities throughout Japan and Korea in the two years was parasitised. The percentage of parasitism among cocoons of the overwintering generation ranged from 6.5 to 96.8, and that of cocoons of the summer generations collected from trap bands and from bark ranged from 5.6 to 39.5; from 0 to 78 per cent. of the cocoons in corrugated paper strips pinned to trees were attacked by parasites. On quince trees, cocoons collected from the bark were more heavily parasitised than those obtained from trap bands. Cocoons exposed on peach trees were more heavily parasitised than those exposed simultaneously on sand pear trees [*Pyrus sinensis*] in adjacent orchards, although the same species of parasites were present in both orchards. Cocoons on the trunk and larger branches of peach trees were found to be more subject to attack by parasites than those near the terminal twigs. Some species of parasites appear to attack chiefly cocoons on certain parts of the trees. Secondary parasites were found to be of importance in relation to the biological

control of *C. molesta* in Japan and Korea. Of the hosts from which parasites of the stages within the cocoon were reared, 16·3 per cent. had been attacked by secondary parasites, 97·3 per cent. of which emerged from the cocoons of parasites of the twig larvae. Secondary parasitism occurred chiefly in cocoons of the summer generations and was of greatest importance in Korea, where the cocoons contained a much greater proportion of larvae previously attacked by parasites of the twig larvae than those in Japan.

Several of the more important species of parasites found to attack *C. molesta* in Japan and Korea were exported to the United States during 1932 and 1933 [cf. *R.A.E.*, A 29 294].

THOROLD (C. A.) & PICKLES (A.). **Control of Pineapple Caterpillar.**—*Trop. Agriculture* 17 no. 11 pp. 215–216, 1 ref. Trinidad, 1940.

An account is given of field experiments in Trinidad in which a proprietary derris dust and a proprietary derris spray both reduced damage to pineapples by the larvae of the Lycaenid, *Tmolus echnion*, L. [cf. *R.A.E.*, A 16 158]. Both insecticides were applied to the fruits only at weekly and fortnightly intervals between 27th March and 4th July, when the last ripe fruit was picked, and the results were estimated by examining the fruits as they ripened. The dust gave the higher proportion of undamaged fruits and showed no reduction in effectiveness when applied fortnightly. It adhered well to the fruits, and it appears, therefore, that fairly heavy applications at intervals of a fortnight or longer may afford satisfactory control. Treatment should be begun as soon as the inflorescences appear and should be continued until the fruit is ready for picking.

PICKLES (A.). **Measures for the Control of Chinch Bug infesting Lawns in Trinidad.**—*Trop. Agriculture* 17 no. 12 pp. 236–237, 5 refs. Trinidad, 1940.

*Blissus insularis*, Barber, has attracted attention in Trinidad owing to the damage it causes to lawns, particularly those of savanna grass (*Axonopus compressus*). There are few records of injury to crops, but it is stated in a footnote that since this paper was written a serious attack on rice was observed in the south of the Island. Bugs of all ages attacked the maturing ears, but did not affect the lower portions of the plants. Serious outbreaks in lawns occurred in 1940, and field experiments were carried out to determine a method of control that could be adopted by householders. Emulsions of lubricating and fuel oils, strong soap solutions, diluted pyrethrum extract and local proprietary dusts of nicotine or derris were ineffective. Good results were, however, obtained by spraying infested lawns with nicotine sulphate in soap solution, the best formula being 2 lb. common blue or mottled soap,  $\frac{1}{2}$  lb. nicotine sulphate and 25 [U.S.] gals. water. This spray was applied once at the rate of 100 [U.S.] gals. per 1,000 sq. ft. from a small power sprayer at a pressure of 200 lb. per sq. in., and the lawn was still free from the bugs two months after treatment. The turf was not injured by the spray.

Almost as good control was obtained by applying from an ordinary watering can, at the rate of 100 [U.S.] gals. to 1,000 sq. ft., an emulsion of  $\frac{1}{2}$  [U.S.] pint carbon bisulphide,  $\frac{1}{2}$  [U.S.] pint coconut oil, 1  $\frac{1}{2}$  lb. common soap and 10 [U.S.] gals. water. The lawn should be watered before treatment until the surface soil is saturated. The emulsion

did not injure the grass, and 18 hours after its application, only 1-2 bugs were found in 50 sq. ft. of lawn. A second application may be necessary in cases of severe infestation. Numerous mole crickets (*Scapteriscus vicinus*, Scud.) were driven to the surface of the treated lawn and died almost immediately.

TREHAN (K. N.). **Studies on the British White-flies (Homoptera, Aleyrodidae).**—*Trans. R. ent. Soc. Lond.* **90** pt. 22 pp. 575-616, 7 figs., many refs. London, 1940.

Descriptions are given of various stages of a number of British Aleurodids investigated by the author during 1936-38, together with an account of the morphology, food-plants and bionomics of some species of which the identity was doubtful. From the results of this study and of rearing experiments with them, he considers that *Aleurodes brassicae*, Wlk., is synonymous with *A. proletella*, L. [cf. *R.A.E.*, A **10** 73], and *A. rubicola*, Dgl., with *A. carpini*, Koch, for which latter he erects a new genus, *Asterobemisia*. He questions whether *Aleurodes fragariae*, Wlk. [cf. **10** 407; **15** 236] is a valid species, since adults collected from strawberry in Hertfordshire and Kent proved to be *A. proletella* and *A. lonicerae*, Wlk., but although both species were reared on this food-plant in the laboratory, immature stages were not found on it in the field. A list is given of the 17 species known or thought to exist in Great Britain, together with keys to the pupae of the 12 species examined and the adults of 11 of them.

Seven species of parasites were bred from the pupae of eight Aleurodids collected in the field, and notes are given on the percentage parasitism of some of them. Attempts in the laboratory to rear several of these parasites on hosts from which they had not been obtained in the field were generally unsuccessful, but *Encarsia partenopcea*, Masi, from *Siphoninus phillyraeae*, Hal., and *E. formosa*, Gah., from *Trialeurodes vaporariorum*, Westw., bred readily on *Aleurodes proletella*.

WILSON (G. F.). **Some Seasonal Pests of Garden Vegetables and their Control.**—*J. R. hort. Soc.* **65** pt. 12 pp. 407-419, 4 pls., 15 refs. London, 1940.

The bionomics of some of the more common insect and other invertebrate pests that attack vegetable crops in Great Britain are briefly reviewed, and methods of preventing and controlling infestation by means of cultural operations and insecticides suitable for use in kitchen gardens are described. The numbers of species of pests of various kinds, including eight Orders of insects, that attack each of 24 vegetable crops in the British Isles are shown in a table, and the distribution and regional importance of the cabbage whitefly, *Aleurodes proletella*, L. (*brassicae*, Wlk.), in England and Wales are outlined on a map to illustrate the fact that certain insects have a restricted range even within the Island. This Aleurodid is stated to have been the only insect pest of vegetables that was much affected by the severe winter of 1939-40; insectivorous birds, on the other hand, were greatly reduced in numbers.

WOOD (J.). **Notes on Pest Control.**—*Kirton agric. J.* 1940 no. 6 pp. 38-40. Worcester, 1940.

Notes are given on the use of mercurous chloride (calomel) for seed treatment against the onion fly [*Hylemyia antiqua*, Mg.] on

onion [*R.A.E.*, A **27** 674] and as a 4 per cent. dust against the cabbage root maggot [*H. brassicae*, Bch.] on cruciferous vegetables [**27** 116], and on treatment of strawberry runners to control Aphids [*Capitophorus fragariae*, Theo.] by dipping them in a solution of nicotine and soft soap [**28** 101].

The importance of controlling potato Aphids in the houses where seed potatoes are set to sprout is pointed out, since they feed on the developing shoots and may transmit virus disease to healthy tubers from infected tubers of stock that has been used for one or two years. Varieties with green, leafy shoots are particularly susceptible to infestation, and colonies of Aphids may be mistaken for leafy growth; the danger of attack increases with the approach of the planting season. The Aphids can readily be controlled by fumigating the houses [**19** 265], in which the trays containing the seed tubers should be stacked so that sufficient space is left to allow the fumigant to diffuse through the house as readily as possible. There is some indication that infected tubers provide a source of infestation for field crops, since many of the Aphids can live in the soil until the shoots appear above the ground.

BARNES (H. F.). **Gall Midges and Grass Seed Production.**—*J. Bd Greenkeep. Res.* **6** no. 21 p. 118 repr. 3 pp., 7 refs. Bingley, Yorks., 1940.

Data on the Cecidomyiids that damage the seed of various grasses, especially in the British Isles, are briefly reviewed [*cf.* *R.A.E.*, A **19** 587; **27** 635; **28** 536; **29** 315]. Cultural methods of control appear to be the most promising, and might include the production of early or late flowering strains of grasses, or the retardation of their flowering periods until after the flight periods of the Cecidomyiids are over. If it were possible to grow the grass in widely-spaced drills, intensive cultivation at certain critical periods in the life-cycle of the Cecidomyiids would reduce their numbers to insignificant proportions.

GEIGY (R.) & ZINKERNAGEL (R.). **Beobachtungen beim Aufbau einer technischen Grosszucht der Kleidermotte (*Tineola biselliella*).** [Observations during the Development of Mass Breeding of the Clothes Moth for Industrial Research.]—*Mitt. schweiz. ent. Ges.* **18** pt. 4-5 pp. 213-232, 12 figs., 15 refs. Berne, 1941.

The observations recorded were made in the course of breeding large numbers of larvae of *Tineola biselliella*, Humm., for tests of a moth-proofing preparation. The larvae burrowed into the woollen material on which they were bred, whether or not it was kept in the dark, but returned to the surface to pupate. The moths paired soon after emergence, and some oviposited in about two days. Oviposition occurred at irregular intervals, and the number of eggs deposited was dependent on the conditions under which the larvae had developed. The larvae, pupae and adults survived temperatures of 8°C. [17.6°F.] and 35°C. [95°F.], but the eggs did not develop at temperatures below 10°C. [50°F.]. The duration of the life-cycle depends largely on temperature and nutrition. At 26°C. [78.8°F.],

with suitable food, the egg, larval and pupal stages lasted about 7, 28 and 10 days, respectively, but such rapid development does not permit the accumulation of sufficient reserves in the fat-body of the larvae, and the resulting adults are stunted. To obtain adults of maximum size, breeding must be carried out at 18–20°C. [64·4–68°F.]. Experiments showed that the larvae develop very slowly on wool that has been washed and thus deprived of fatty material. It is therefore concluded that keratin alone is an unsatisfactory diet, and specially treated wool was used for breeding purposes. The sexes usually occurred in equal numbers, but males predominated in old colonies with much larval excreta and a scanty food supply.

Several parasites and predators were observed in the cultures, and their increase was favoured by the density of the host population. The larvae were parasitised by the Braconid, *Apanteles carpatus*, Say, which had previously been recorded only from the United States, and which lays one egg in each host, and by an undescribed Eulophid of the genus *Tetrastichus*, which deposited 4–20 eggs in each larva and multiplied rapidly, but did not attack larvae in the deeper layers of wool. Larvae and adults were attacked by *Pediculoides ventricosus*, Newp., and the eggs and adults by *Typhlodromus tineivorus*, Oudm., and another mite of the same genus. *T. tineivorus* also attacks larvae of *Dermestes lardarius*, L., and *Anthrenus*. Larvae and adults of *Tineola* in the cultures were infected to varying degrees with a Microsporidian, probably of the genus *Nosema*. It was found in various organs, including the ovaries, which indicates the possibility of hereditary transmission. No cases of infection were observed among moths taken in nature.

JULLIARD (R.). **Observations biologiques sur *Balaninus nucum* L.**—*Mitt. schweiz. ent. Ges.* **18** pt. 4–5 pp. 295–296. Berne, 1941.

A good crop was obtained from hazel [*Corylus avellana*] in the canton of Geneva in 1936, but about 50 per cent. of the nuts were infested by *Curculio (Balaninus) nucum*, L. The oviposition puncture was usually near the tip, but sometimes near the stem. There was never more than one larva per nut; 34 larvae issued from 40 infested nuts, but the other 6 failed to do so before the shells became too hard for them. Normal larval emergence from the nuts occurred from 28th August to 2nd September. The larvae entered the ground, and newly emerged adults were found in the soil a year later. It appeared likely that they would not become active until the following year, as adults usually occur on the hazel bushes from the end of May onwards.

#### PAPERS NOTICED BY TITLE ONLY.

EICHMANN (R. D.) & WEBSTER (R. L.). **The Influence of Alfalfa [lucerne] on the Abundance of the Pea Aphid [*Macrosiphum onobrychis*, Boy.] on Peas grown for Canning in southeastern Washington.**—*Bull. Wash. St. agric. Exp. Sta.* no. 389, 36 pp., 15 figs., 2 pp. refs. Pullman, Wash., 1940. [For briefer account see *R.A.E.*, A **28** 621.]

WATERSTON (J. M.). **Supplementary List of Bermuda Insects, 1928–1940.**—10 pp. Hamilton, Dep. Agric. Bermuda, 1940. [Cf. *R.A.E.*, A **17** 26.]

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